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Assessing the Impact of Regulation on Deployment of Fiber to the Home

A Comparative Business Case Analysis

Prepared for:

CORNING

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Today's discussion

- Background & Executive Summary
- Free Market Scenario
- Regulated Scenario
- Conclusions
- Appendix

This study examines the potential effects of regulation on the extent of fiber to the home (FTTH) deployment as part of a network overbuild by an ILEC or other provider

- In order to determine the number of households covered by FTTH in a scenario with regulation compared to a free market, we analyze the network overbuild deployment decision by an ILEC on a case by case basis for a representative group of COs and extrapolate our results to the US as a whole
  - Our analysis is based on actual wirecenter data, third party market forecasts, and mainstream estimates of capital equipment costs and general expenses
  - The competitive advantage of FTTH is in providing consumers with next generation data and video services at a good value compared to today's copper and cable based offerings
  - In the free market scenario, an ILEC building a FTTH network is not obligated to unbundle it for use by competitors
  - In the regulated scenario, we assume that an ILEC overbuilding its own territory is required to offer competitors resale and UNE based access to its fiber plant
- In this later scenario, it would be more attractive for any CLECs to piggy-back on the newly built ILEC network than to invest in their own facilities
- In the free market, case we believe that a competitor could undertake a similar network overbuild of the ILEC with as good or better economic results
- In both scenarios, we assume that the ILEC's legacy copper plant is retained. Relaxing this assumption could potentially enable network cost savings and accelerate FTTH deployment
- We do not explicitly consider a greenfield FTTH scenario, but we believe that in most cases it would have more attractive economics than the overbuild situation we examine here

Our results indicate significantly greater deployment of FTTH under the free market approach due to greater revenue potential and lower direct and indirect costs associated with regulation

- We estimate that FTTH could be economically deployed in 31% of households in a free market compared to 5% of households under regulation (roughly a 6X differential)
  - In a scenario with more aggressive service penetration assumptions, deployment is expected to be 41% in a free market and 17% under regulation
  - In a more conservative scenario, deployment is expected to be 15% in a free market and <1% under regulation
- The household coverage in our base case scenario corresponds to 8% of wirecenters nationwide in a free market, but only 1% with mandated unbundling
- Similarly, FTTH capital expenditures by the ILECs will reach nearly $45 billion in free market conditions, compared to just over $5 billion under regulation
- Incremental ILEC revenues in 2013 are expected to reach close to $22 billion in free market conditions, but just exceed $2 billion under regulation

Service providers have tested FTTH technology intermittently over the last ten years, but currently only about 34,000 US homes have access to FTTH, delivered primarily by CLECs. Recent improvements in equipment economics have led many providers to consider wider deployment

CLECs Outpace RBOCs in FTTH Deployment

Sample CLEC Projects

Eagle Broadband

- 24,000 homes passed (Houston & Austin, TX)

Daniel Island Media

- 800 homes currently passed. 5000 planned homes passed (Daniel Island, SC)

Nex-Tech

- 650 homes passed (Almena & Norton, KS)

RBOC Projects

BellSouth

- Trials in Dunwoody, GA (400 homes passed)

Qwest

- No FTTH plans released to date

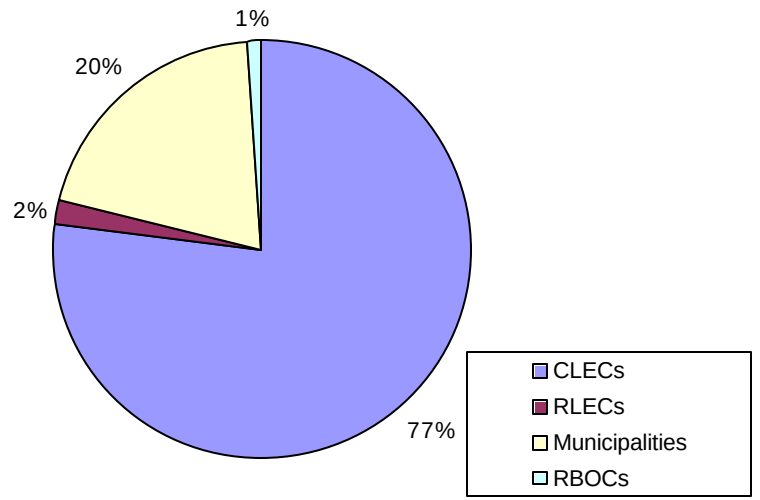
SBC

- Announced greenfield build in Mission Bay, CA (500 homes passed upon completion)

Verizon

- Greenfield build in Brambleton, VA (680 home development under construction)

34,000 Homes Currently Passed by FTTH



0.03% of US Households Currently Addressed by FTTH

Note: A smaller fraction of these homes actually currently subscribe to FTTH. See appendix for more detail

Source: Communications Industry Researchers, 2001; Company Press Releases, CSMG Analysis

Despite prospective improvements in FTTH equipment costs, significant questions exist concerning the impact of regulation on overall FTTH economics, and hence deployment. Corning has asked CSMG to examine these questions and assess the extent to which regulation is constraining deployment of FTTH and related advanced services

Regulation and Expected ILEC Deployment of a Fiber to the Home Network Overbuild

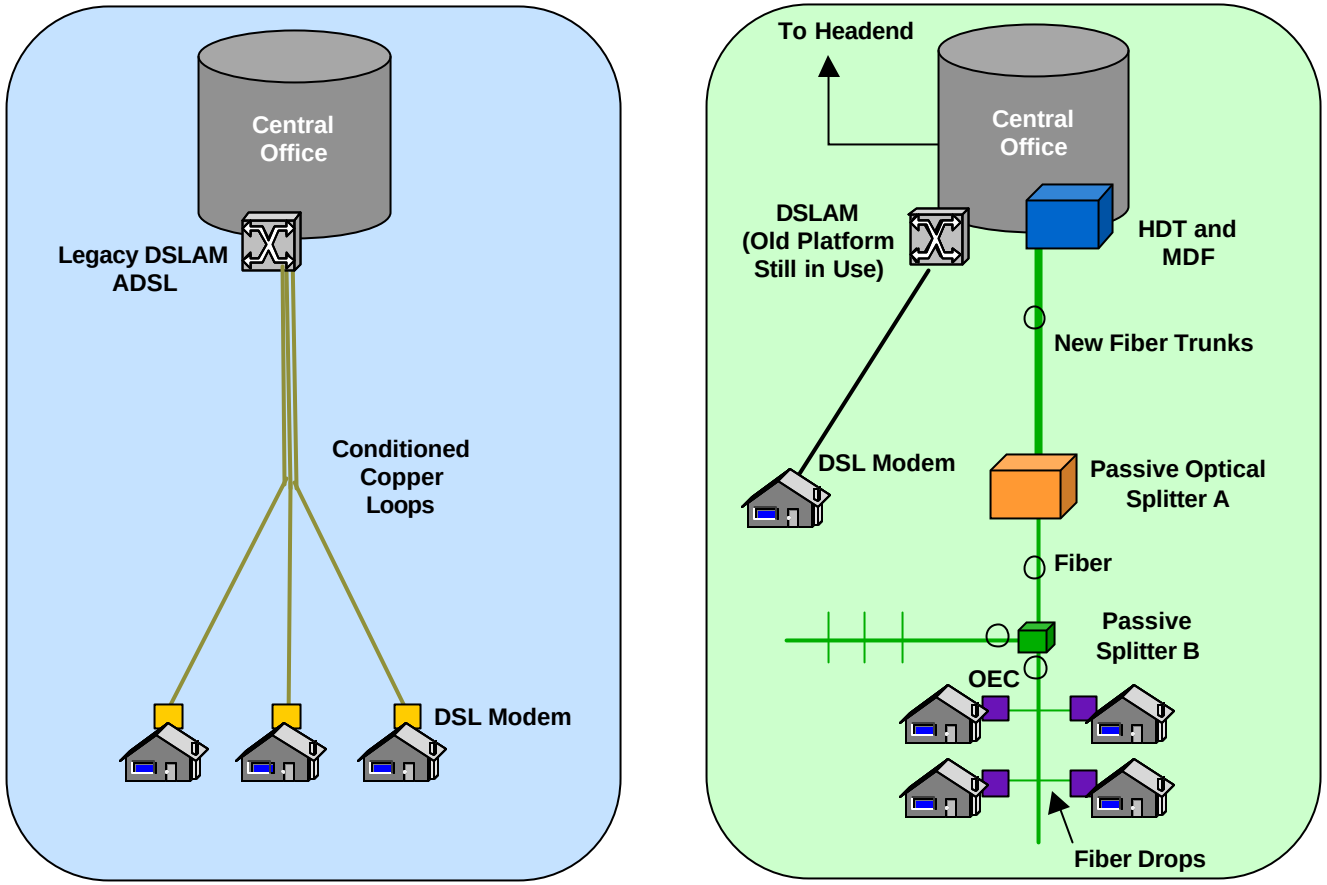
Free Market Scenario	*Potential Effect of Regulation*	*Regulated Scenario*
• ILEC builds new fiber to the home network to compete with cable and other broadband platforms • New video and higher bandwidth services are rolled-out • Legacy copper plant is maintained (though relaxing this assumption could enable further cost savings for the ILEC)	• Direct costs of regulation – Increased CAPEX – Systems integration costs – More personnel • Lower share of services on new platform • Higher perceived risk of investment – Lower expected returns – Higher threshold for investment	• ILECs build fiber to the home and are required to sell access to their newly constructed facilities at long term incremental cost for unbundled network elements (UNEs) • CLECs compete for customers using FTTH UNEs to enter the market at low cost; these entrants take share from the ILECs and lower the ILEC's incremental returns on invested capital • Increased risk of competition and lower financial returns make fewer COs look attractive, resulting in fewer FTTH deployments
Some FTTH Deployment?		***Significantly less FTTH Deployment?***

For the purposes of this study we consider fiber to the home as one basic network alternative to the status quo. These two architectures act as bookends describing the current potential range of advanced services deployment. We consider FTTH under both free market and regulated scenarios

Range of Network Alternatives

Status Quo
(For Comparison Purposes)

Fiber to the Home
(Overbuild of Status Quo)



Range of Regulatory Alternatives for FTTH Scenario

Free Market

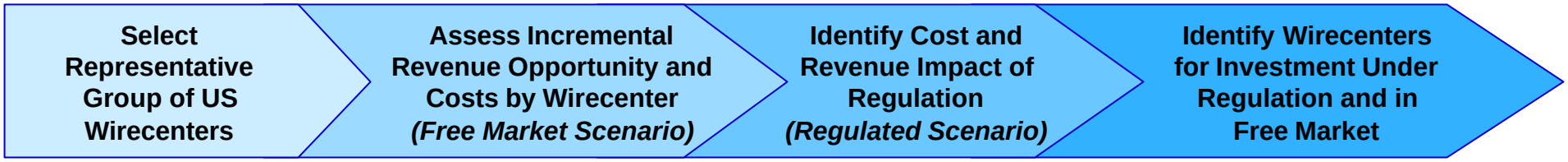
- ILEC is not required to unbundle or resell newly built FTTH network

Regulated

- ILEC is required to unbundle fiber plant and CO equipment and offer it to CLECs on a TELRIC or similar cost basis
- Fiber platform resale is available but is assumed to be uneconomic for most CLECs (discussed in more detail later)
- Recurring fiber drop costs are included in the loop unbundling cost, and any one-off drop costs are recouped by ILEC in UNE installation rates
- CPE is not unbundled

Our approach to answering this question used actual wirecenter data to identify where residential FTTH is financially attractive. This allowed us to compare the level of expected deployment under mandated UNE regulation and under a free market approach

Basic CSMG Methodology



- Use all 1500 Texas COs (a state representative of the US as a whole)* as a sample for model
- Gather detailed demographic, geographic & network characteristics for these COs
- Confirm representative distribution of population densities, income and fiber characteristics for this sample

- Assuming a free market environment, use individual CO demographics and expected service take rates to determine the incremental revenue opportunity of FTTH
- Evaluate likely FTTH CAPEX in each CO based on population density and outside plant criteria
- Determine likely incremental OPEX and SG&A expenses required to offer service

- For a regulated scenario, estimate incremental capital costs of opening the network to competitors
- Identify direct OPEX costs of opening network
- Evaluate reduced share and lower revenue opportunity for ILEC, accounting for wholesale UNE revenues
- Consider impact of increased project risk, which requires higher returns in order to meet threshold for investment

- Based on this framework, determine which COs are NPV positive in a free market scenario and in a regulated scenario
- Estimate total number of households "passed" in each regulatory scenario and difference in coverage

Throughout the rest of the analysis we explicitly consider the case of the ILEC, however we believe CLECs could deploy FTTH with similar or better economics

*See appendix

Our business case model uses CO level data to calculate the incremental revenue opportunity, OPEX and CAPEX required in a full rehab or overbuild of the existing network. Running this model for a representative group of COs allows us to identify the areas in which FTTH could feasibly be deployed under the two regulatory scenarios

CO Level Data

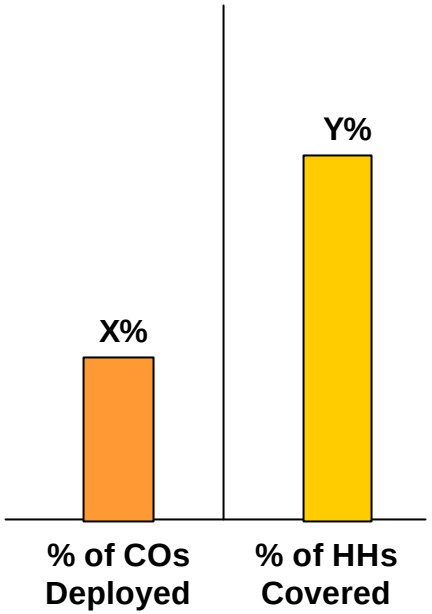
CLLI	LEC_ID	CITY
HGHLTXXA	2059	SCHULENBURG
OKHRTXXA	2068	OAKHURST
CHARTXXA	2141	CHARLIE
EDCHTXED	9533	EDCOUCH
RCDLTXRD	9533	ROCKDALE
PTLVTXXA	4344	PRT LAVACA
LBCKTXSW	9533	LUBBOCK
SNANTXFR	9533	SAN ANTONIO
STNWTXXA	4344	STONEWALL
ASTNTXAS	9533	ASHERTON
CSVLTXCT	9533	CASTROVILLE
LEVLTXXA	2083	LEESVILLE
PYTETXPA	9533	PYOTE
DCSNTXXA	4344	DICKINSON
LMTNTXLM	9533	LUMBERTON
VLVWTXXA	2116	VLY VIEW
BGCNTXXA	2039	BIG CANYON
NBRNTXNB	9533	NEW BRAUNFELS
TEPHTXXA	2154	TELEPHONE
DKLBTXXA	1163	DE KALB
FTWOTXPE	9533	FT WORTH
CLSTTXXD	4344	COLLEGE STA
NCHSTXXA	2084	NECHES
GDSPTXXA	2068	GOOD SPRINGS
LTHRTXXA	2168	LUTHER
ELPSTXMS	9533	EL PASO
SYMRTXXA	1163	SEYMOUR
DLLSTXMS	9533	MESQUITE
KGLDTXXA	4344	KINGSLAND
SPRNTXSO	9533	SPG
DHNSTXXA	2135	DHANIS

Single CO Model Engine

- *Incremental revenue—including share loss reduction*
- *Incremental Operating Costs*
- *Project CAPEX*

Is CO NPV Positive or Negative?

CO by CO Deployment Results



- Data on central office density, ADSL addressability, household income, number of households and status of outside plant for each CO in Texas

- Engine calculates total opportunity based on the incremental revenues created by a FTTH deployment and the capital and operating costs incurred

- The ILEC in question will build FTTH to certain sections of NPV positive COs
- The households covered will be depend on the size of COs covered

In either regulatory scenario, the key drivers of the deployment decision in a given CO are household density, existing ADSL addressability, household income, number of households in the CO and type of outside plant (aerial vs buried)

Analyses Performed

1

Status Quo Scenario

- ADSL broadband data
- No video
- Significant voice competitive line loss

2

Free Market Fiber to the Home Scenario

- Deploy fiber to the home in select parts of economically viable COs
- Higher data revenues
- New video data stream
- Lower competitive line loss than status quo

3

Regulated Fiber to the Home Scenario

- Deploy fiber to the home in select parts of economically viable COs
- Required unbundling of fiber plant and certain CO equipment
- Significantly lower share of voice, data and video than free market case

Key Revenue Drivers & Assumptions

- Retail local and LD voice revenues built by line/household count and average revenue per user (ARPU)
- Retail DSL revenues by household based on current penetrations and third party forecasts
- No ILEC video revenue

- Voice modeled as above, but with lower competitive line loss (based on more attractive ILEC package of services)
- Bundling increases in importance as high share of customer telecom "wallet" drives profitability
- FTTH enables ILEC penetration of video market

- All revenue streams are as modeled above, but a significant portion of each revenue stream is lost to UNE based FTTH competitors
- Some of this lost revenue is recouped in the form of wholesale UNE revenue

Key CAPEX & Expense Drivers & Assumptions

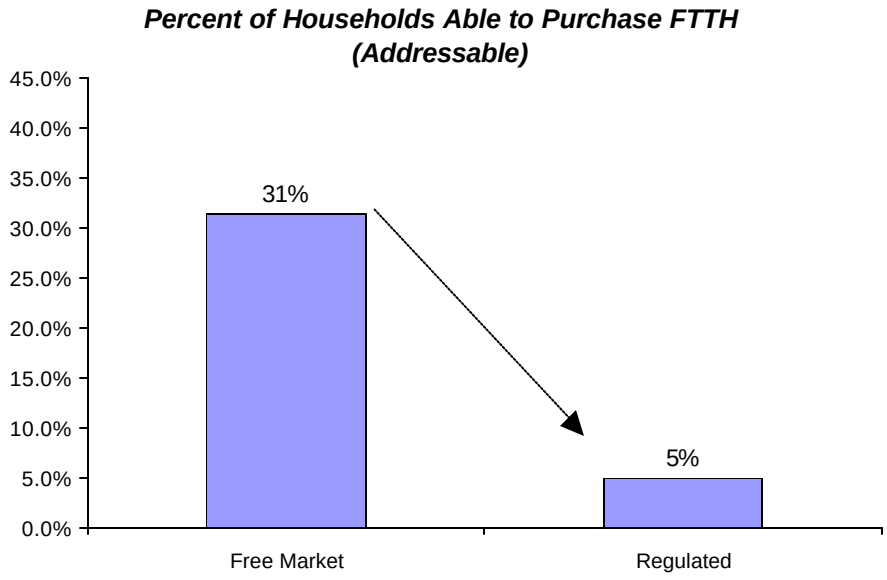
- No incremental CapEx beyond current deployment
- COGS, marketing expense, and G&A calculated as a percent of revenue

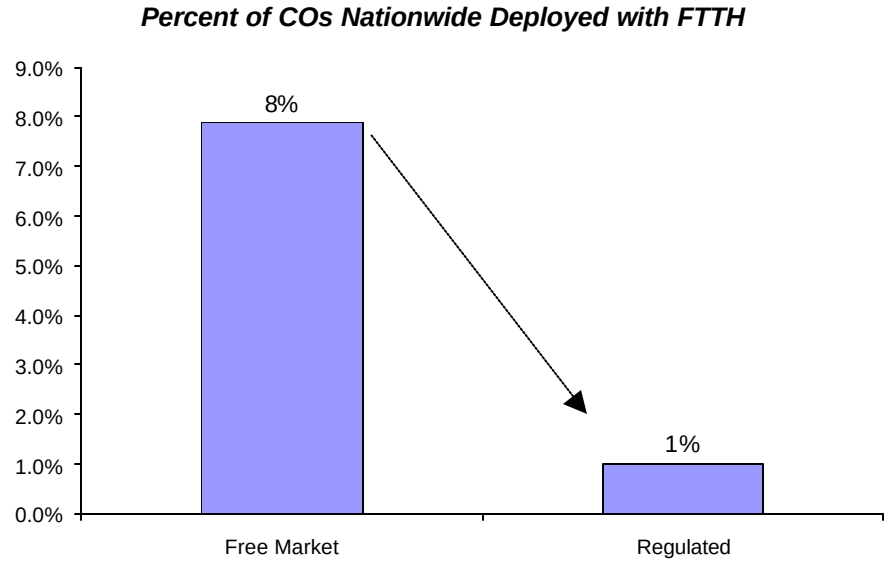
- Incremental fiber costs per market primarily driven by aerial vs. terrestrial plant and household density
- Incremental CO equipment required per market based on FTTH architecture
- Incremental fiber, line card and CPE costs per home based on FTTH architecture
- COGS and OPEX calculated as percent of revenue

- Incremental CAPEX is required in the CO to accommodate interconnection by UNE wholesale customers
- OPEX is slightly higher due to added complexity of CLEC management
- The ILEC perceives deployment as more risky, hence required rate of return is higher

What did we find? Significantly greater deployment under the free market approach because of greater revenue potential and lower costs associated with regulation

- Our analysis indicates that FTTH would be feasible in 8% of wirecenters nationwide in a free market, but only 1% with mandated unbundling
- This corresponds to 31% and 5% of households respectively
- Assumes 2003 fiber build economics and gradual customer acquisition over 10 years starting in 2003



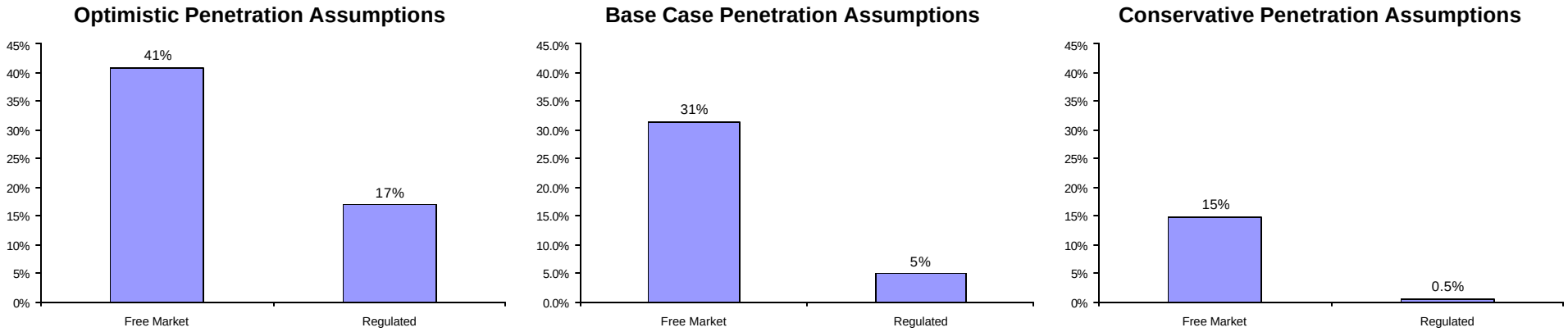


The sections that follow describe our methodology and results in greater detail

Our results are most sensitive to the assumptions made concerning the level of market penetration that a FTTH provider can achieve. However, under any reasonable range of assumptions, FTTH deployment is likely to be substantially higher in a free market environment compared to the regulated scenario

- In the optimistic and conservative scenarios below, we assume service penetration is 20% above and below the base case levels respectively
- Increases in the percentage of households covered in a free market are largely mirrored by increases in coverage under regulation. The differential between these two varies between 15 and 26 points depending on the scenario

Percent of Households Able to Purchase FTTH (Addressable)

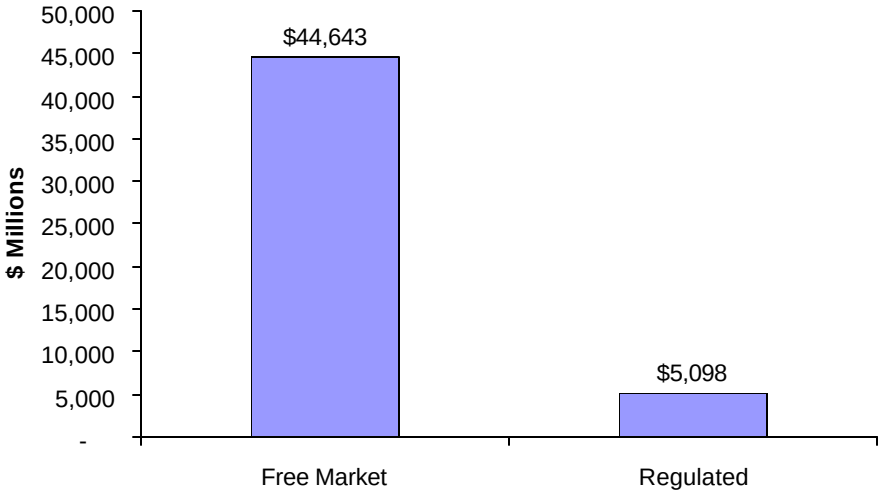


See appendix for more detailed sensitivities

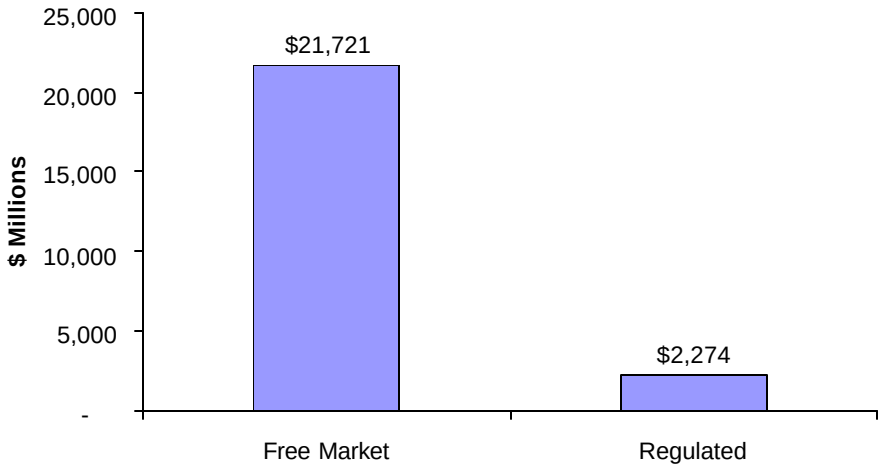
When the results from the base case are extrapolated to the US as a whole, this 26 point reduction in HH coverage under regulation corresponds to:

- $39B less investment in CAPEX over the next ten years
- $19B in lower 2013 incremental annual revenues for the ILECs

Cumulative FTTH Capital Expenditures (2003-2013)



Annual ILEC Incremental FTTH Services Revenue (2013)



The ILEC overbuild scenario we have modeled represents a baseline from which to infer the effects of regulation on two related situations: 1) A greenfield build by an ILEC and 2) A CLEC overbuild of ILEC territory

1) Greenfield Build

Fiber to the home economics would generally be more attractive for an ILEC in a greenfield development than in an overbuild, but regulatory obligations would likely deter the ILEC from deployment

- In the case of a greenfield build (typically a Planned Unit Development or PUD), a company develops a community of homes and takes charge of providing many utility services. Typically a bidding process takes place for a telecom services master contract
- Revenue in this situation may be higher than in a competitive overbuild, since the company offering service would, at a minimum, be the preferred provider. In many situations, some or all of services may be rolled into homeowner association fees
- From an ILEC's perspective, there would be no cannibalization of legacy voice and data revenue streams in a greenfield build, and thus all revenues would be considered incremental for the calculation of returns
- CapEx and OpEx could be lower in this scenario than in an overbuild due to reduced fiber installation costs (e.g. timing of construction would mean no street cuts or restoration), and because fiber is generally less expensive to maintain than copper
- However, if the ILEC (alone among all providers) is required to unbundle its new FTTH plant while other companies have no such obligation, then the ILEC would be at a disadvantage to other parties in a competitive bid to build and provide service, and would likely be discouraged from offering FTTH

2) CLEC Overbuild of ILEC plant

In both a regulated and a free market scenario, a CLEC would likely have FTTH economics that would be similar or better than the ILEC for two reasons: 1) All voice and data revenue can be considered incremental (i.e. a CLEC would have no cannibalization of legacy products), and 2) Build costs could be lower due to the use of lower-cost contract labor. Regulated unbundling of ILEC fiber plant would only serve to further skew FTTH economics towards CLECs, lowering the likelihood that a given area is overbuilt with fiber

Today's discussion

- Background & Executive Summary
- **Free Market Scenario**
- Regulated Scenario
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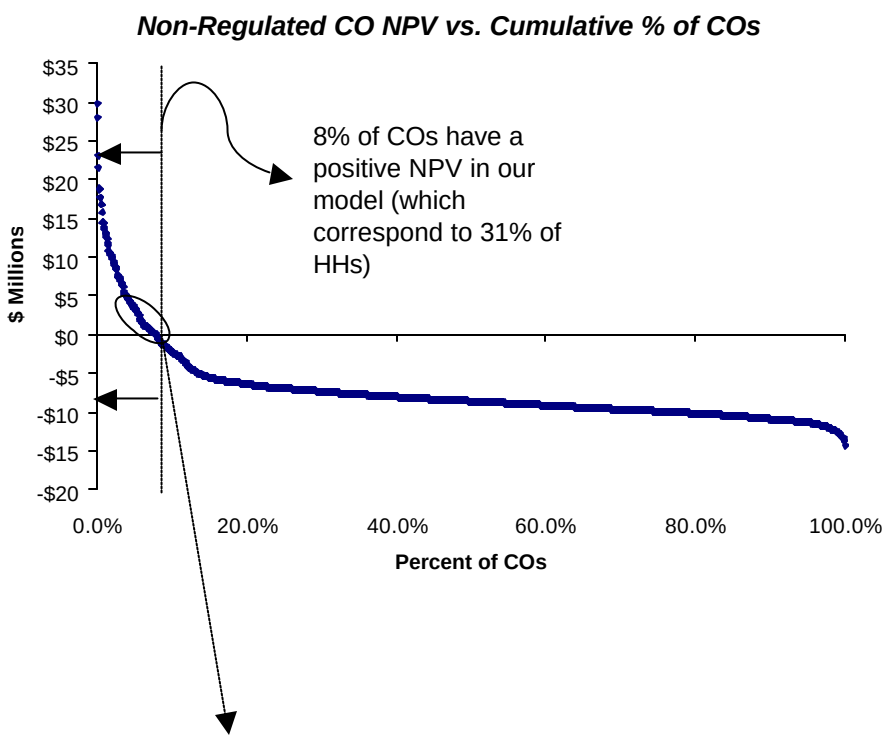
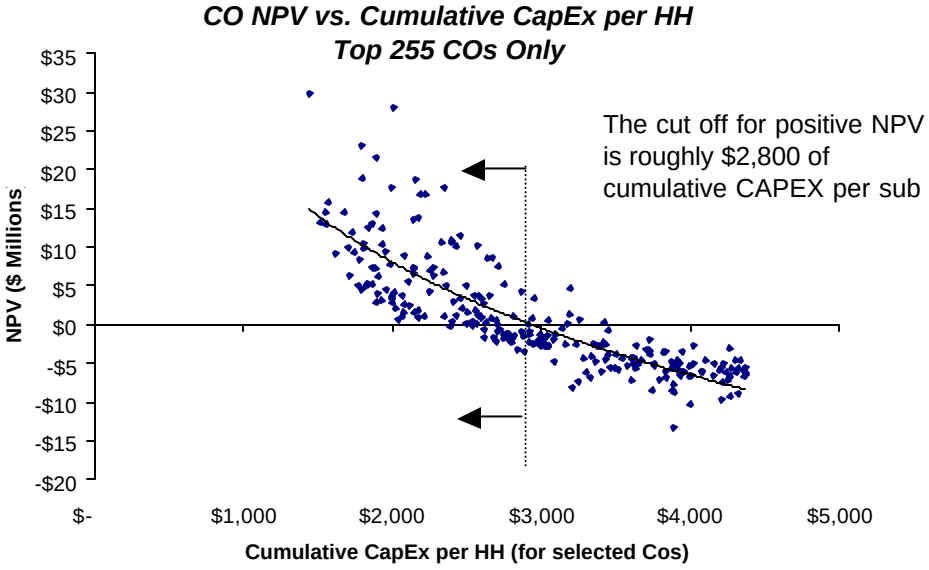
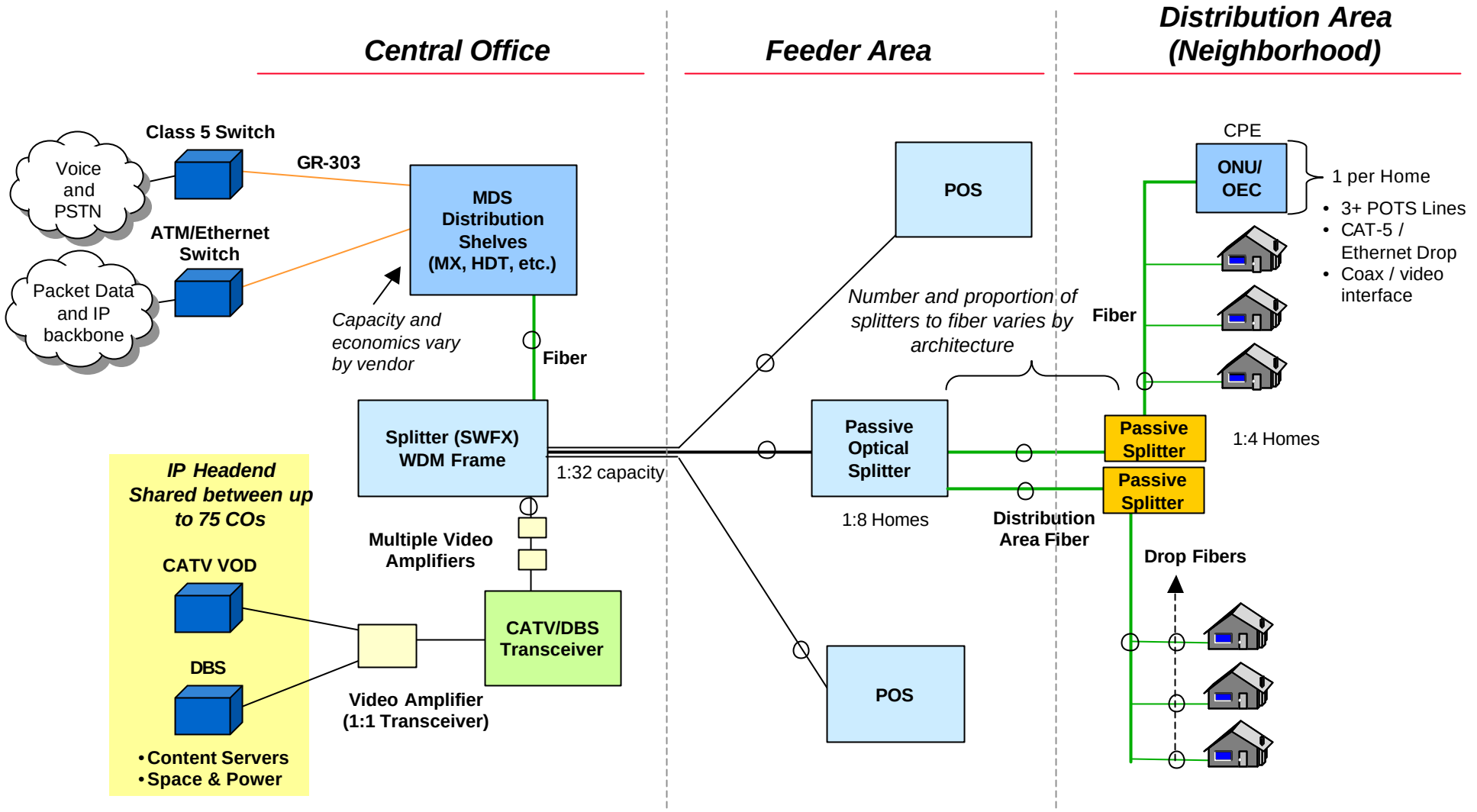
In the free market case, our analysis shows that 8% of the wirecenters produce acceptable returns for FTTH deployment, covering 31% of the households in the sample. The CAPEX per subscriber cut off for deployment is generally in the range of $2,800, consistent with the views of FTTH equipment providers





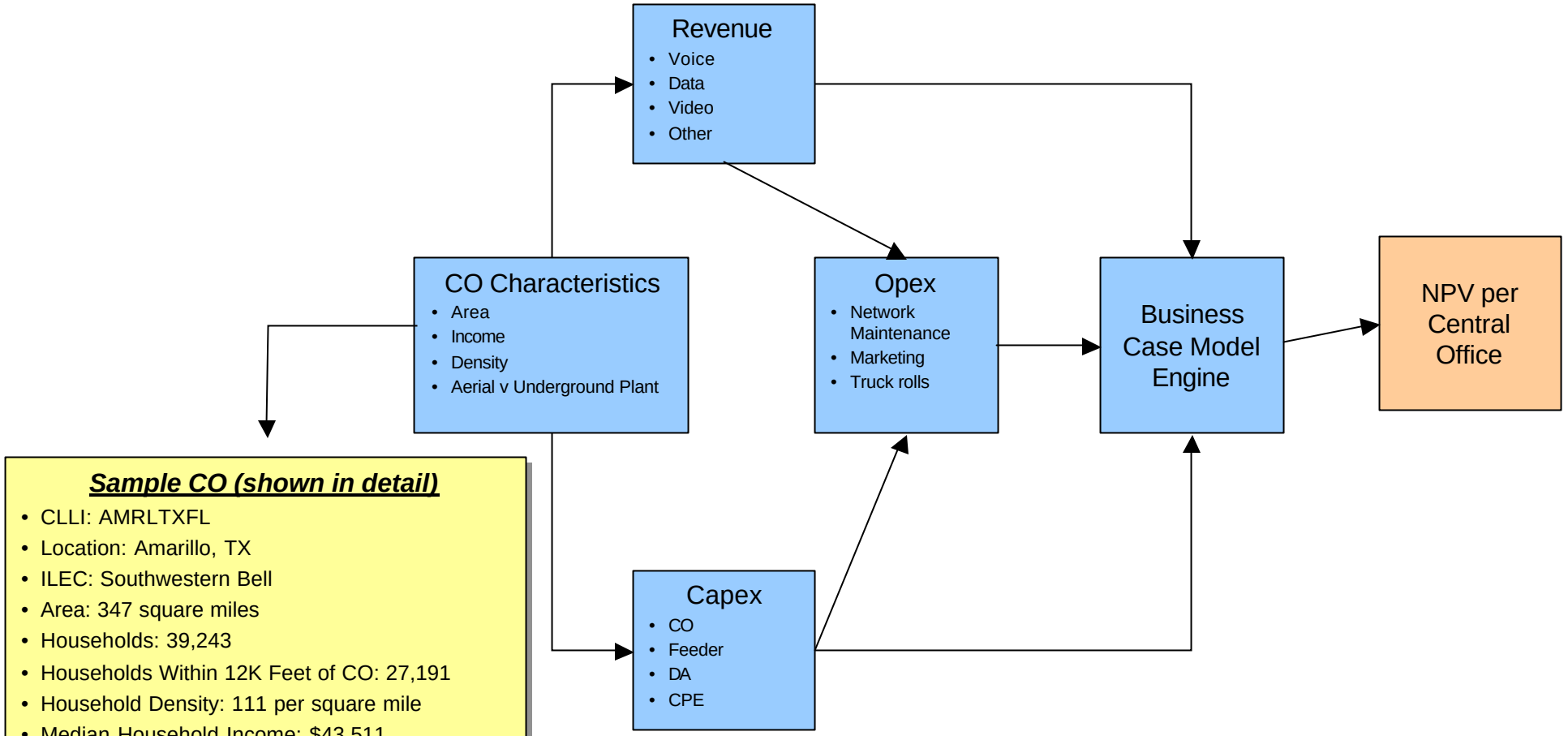
Note that individual companies may decide to deploy to some NPV negative COs for geographic or strategic reasons, while at the same time excluding some nominally NPV positive COs. However, we believe that in aggregate our estimate is indicative of the likely extent of FTTH deployment

This result is based on a generic passive optical network platform capable of delivering POTS, IP video, and very high speed data. We developed architecture & costs assumptions using inputs from Optical Solutions Inc., Alloptic, and Marconi*



*Light Reading, an industry publication, has recently reported that Marconi is cutting its FTTH access product line

We built a ten year revenue, capital and operating cost profile for each CO in order to evaluate the business case for FTTH on a case by case basis



The following pages describe our modeling in more detail and provide results for an illustrative CO (AMRLTXFL in Amarillo TX)

We developed the estimated revenue opportunity based on the demographics of each wirecenter. In particular we focused on the potential incremental revenue of each product (over what could be expected in the status quo ADSL deployment)

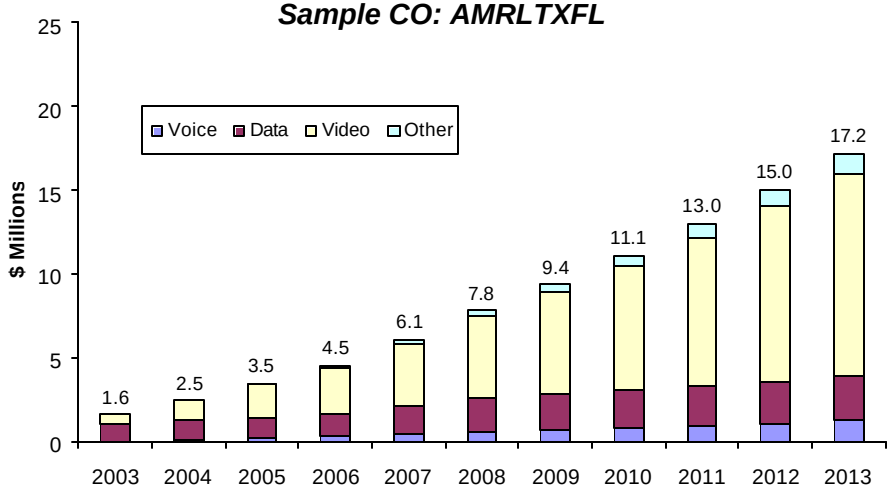
FTTH Service Offering

Product	*Product Description & Positioning*	*Model Methodology for Incremental Revenue*	*Key Assumptions*
Voice	• Up to three POTS voice lines sold at normal ILEC prices • Bundled offering with superior data and video products helps to stem competitive voice line loss	• Count local and LD revenues from customers who would have defected to other platforms in status quo scenario • Voice-only customers remain on legacy copper network	• Local spend rising from $31 in 2003 to $38 in 2013 per HH per month, while LD falls from $17 to $11 • ILEC share of local customers falling from 87% in 2003 to 66% in 2013 without ILEC FTTH deployment • ILEC LD share of ILEC local HH's rising from 5% in 2003 to 35% in 2013 (a very conservative figure)
High Speed Data (Internet)	• Very high speed burstable data service offering up to 20 Mbps of downstream bandwidth • Assumed average throughput increases from 1.5 Mbps in 2003 to 10Mbps in 2013	• Higher incremental data revenues in FTTH case compared to status quo due to: – Increased data addressability – Higher share of data subscribers – Higher ARPUs	• Broadband data revenue per household is $50/month in 2003 falling to $40 in 2013 • ILEC share of broadband customers increases from 40% in 2003 to 55% in 2013 • Penetration of high speed data is higher in COs with higher HH incomes, consistent with market experience
Video	• Digital cable equivalent video service • Real VOD & HDTV service later in forecast period • Positioned as better value than cable	• Video spend scales with household income, consistent with market experience • All video revenue is considered incremental for the purposes of the business case	• Basic Cable Revenue per Household increases from $48 in 2003 to $70 in 2013 • VoD/PPV Revenue per Household increases from $9 in 2003 to $12 in 2013 • ILEC penetration of video (via the FTTH platform) increases from 3% in 2003 to 40% in 2013 • Video ARPU is higher in COs with higher HH incomes
Other Revenue	• CPE and set-top box equipment fees (if any) • No installation fees • In later years, other offerings such as video conferencing and VPN service	• All "other" revenue is considered incremental for the business case	• Other services annual ARPU increases from $4 in 2003 to $10 in 2013 • Take rate of other services increases from 15% in 2003 to 65% of ILEC FTTH households in 2013

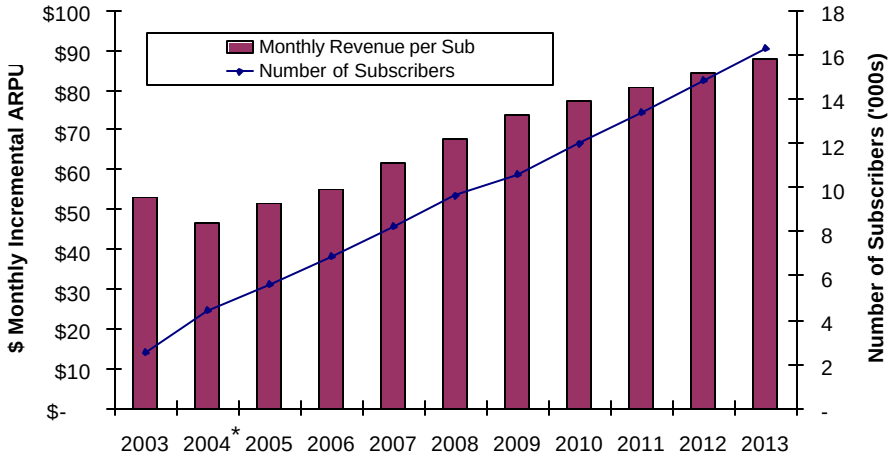
Source: FCC, IDC, JP Morgan, McKinsey, Yankee Group, Gartner, Kagan, Merrill Lynch, MSDW, CSMG Analysis

For our sample CO, incremental revenues are expected to be primarily driven by market share gains in video and data services

Incremental Revenue from FTTH Products
Sample CO: AMRLTXFL



Incremental ILEC Revenue per Subscriber and Subscriber Count for Sample CO: AMRLTXFL



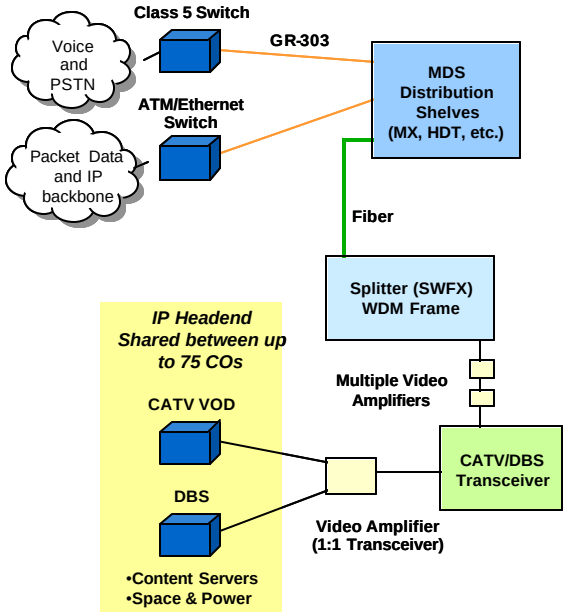
Sample CO

- CLLI: AMRLTXFL
- Location: Amarillo, TX
- ILEC: Southwestern Bell
- Households: 39,243
- Median Household Income: $43,511

*Note: Average incremental ARPU drops from 2003 to 2004 due to the conversion of a large number of legacy DSL customers from the copper plant onto FTTH; for these customers, the ILEC only gains the difference between the FTTH data price and ADSL price

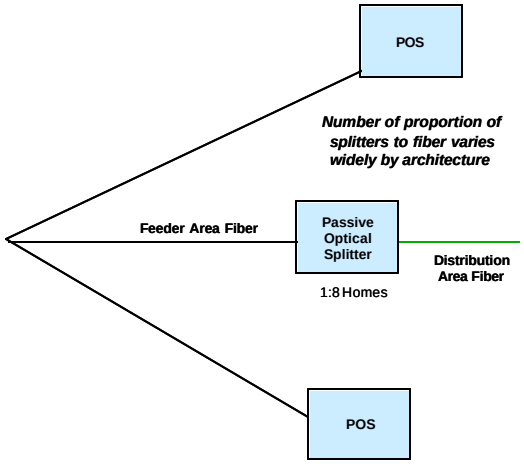
CAPEX is based on a focused* fiber build (as opposed to a total CO build,) and is calculated according to basic cost buckets of fixed and variable cost in the CO, fiber construction costs, CPE and variable plant and equipment

Central Office



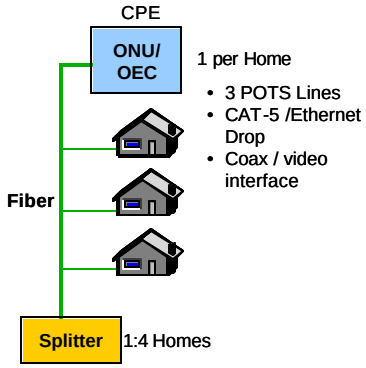
Item	*Value*	*Annual Price Decline*
Initial CO Capex	$200,000	0%
Headend (serves 50 COs)	$2,000,000	0%
Variable CO Capex (per Homes Passed)	$20	20%

Feeder Area



Item	*Value*	*Annual Price Decline*
Aerial Build & Fiber Cost -Feeder Area	$11/foot	0%
Buried Build & Fiber Cost -Feeder Area	$38/foot	0%

Distribution Area (Neighborhood)

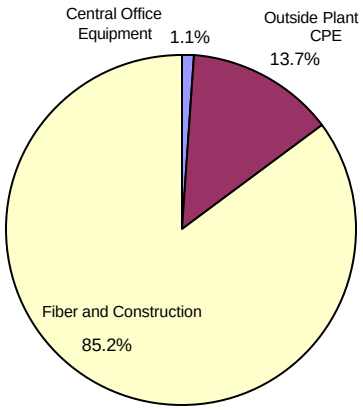


Item	*Value*	*Annual Price Decline*
Aerial Build & Fiber Cost -Feeder Area	$10/foot	0%
Buried Build & Fiber Cost -Feeder Area	$34/foot	0%
Drop Cost per Home (equip only)	$40	20%
CPE Cost per Home	$600	20%

* See appendix for more complete discussion

Cumulative CAPEX is expected to be $37M in the sample CO of Amarillo Texas, while cumulative CAPEX per sub is expected to decrease to just over $2200 per subscriber by 2013

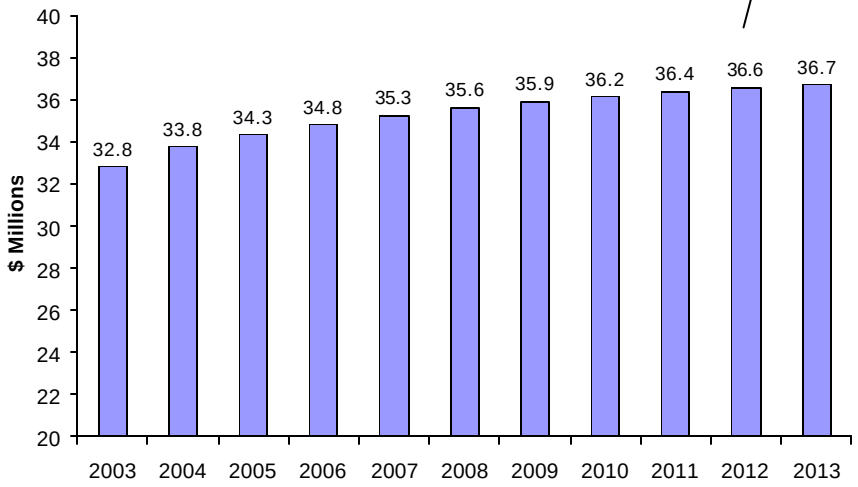
Distribution of Capital Expenditures
Sample CO: AMRLTXFL



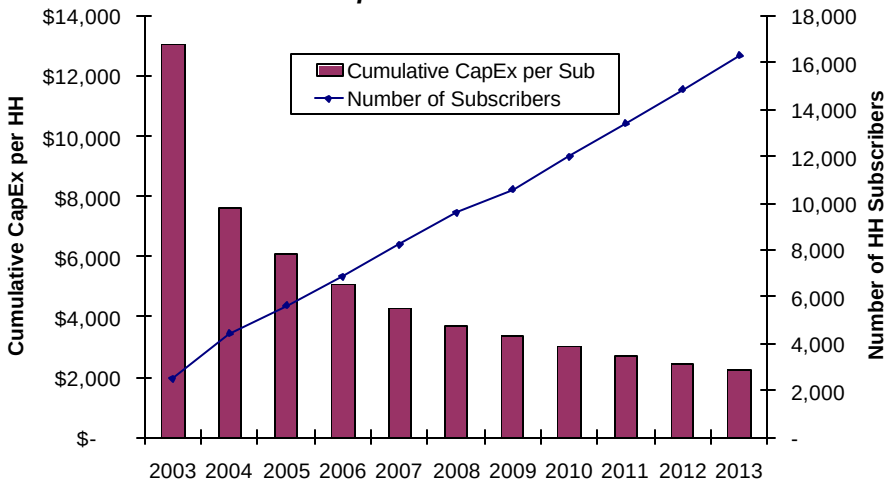
Sample CO

- CLLI: AMRLTXFL
- Location: Amarillo, TX
- ILEC: Southwestern Bell
- Households Within 12K Feet of CO: 27,191
- Household Density: 111 per square mile
- Plant Mix: 54% Underground / 46% Aerial

Cumulative Capital Expenditures
Sample CO: AMRLTXFL

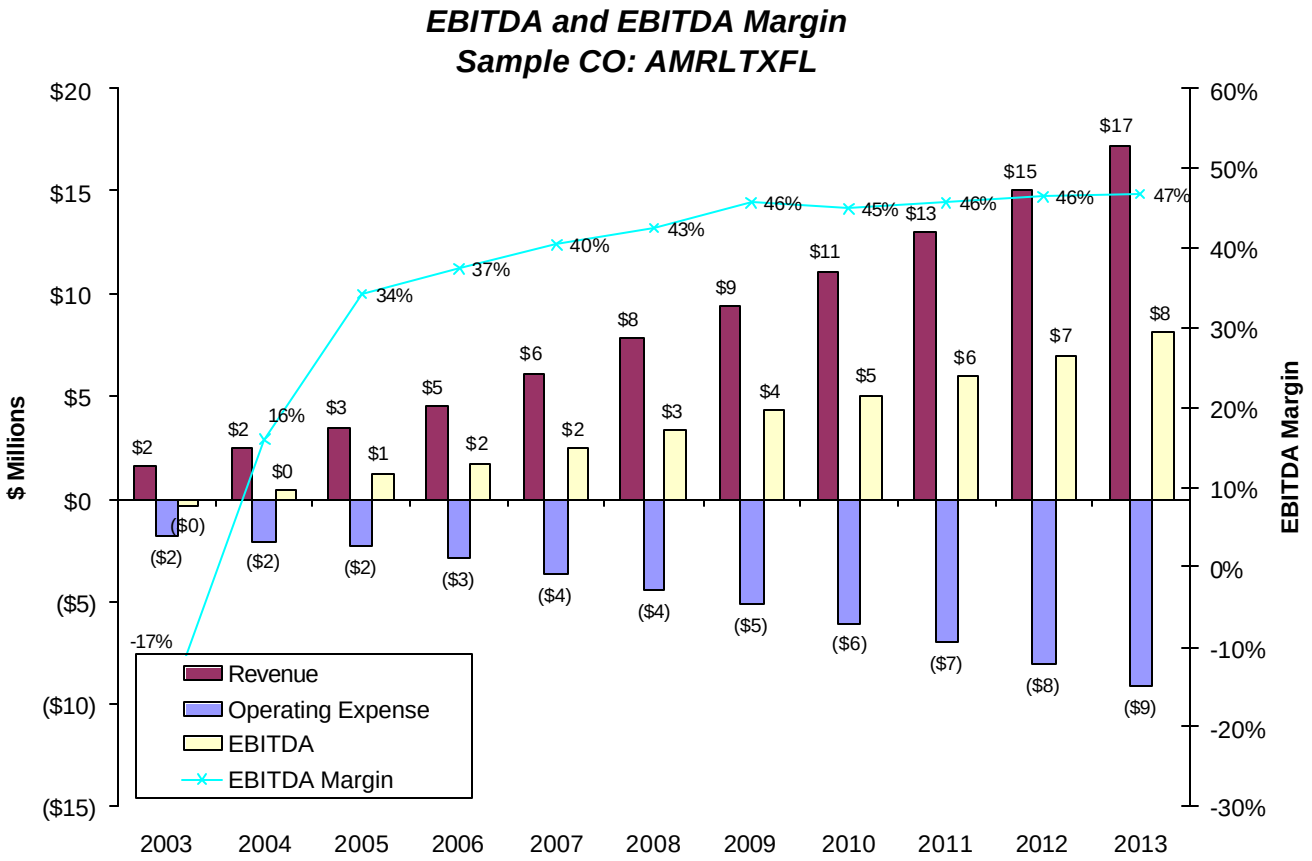


Cumulative CapEx per Sub vs. Number of Subs
Sample CO: AMRLTXFL



CSMG

For the sample CO, EBITDA margins are expected to rise to 47% by 2013 based on OpEx assumptions for gross margin, network maintenance, marketing, installation expense, and incremental SG&A



Key Assumptions

- Gross Margin by Product:
  - Voice: 70%
  - Data: 56%
  - Video: 55% in 2002 falling to 50% in 2013
  - Other: 70%
- Network maintenance 3% of cumulative non-fiber CapEx
- Incremental marketing cost of $150 per gross add
- Incremental sales cost of $100 per gross add
- Cost per installation of $175/HH
- Incremental G&A of 1% of revenue (to account for higher management and corporate costs)

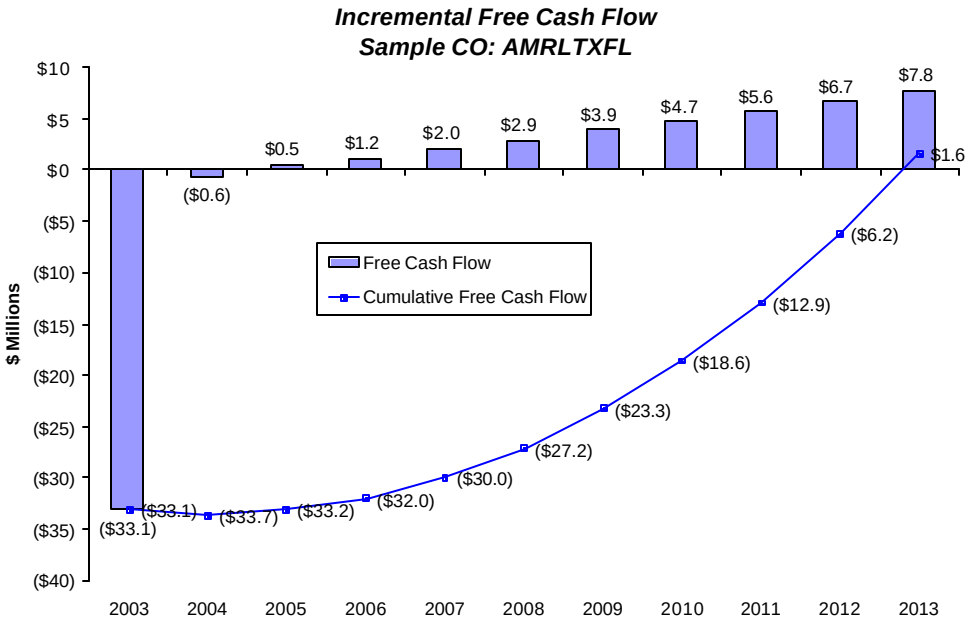
Source: Company Reports, MSDW, CSMG Analysis

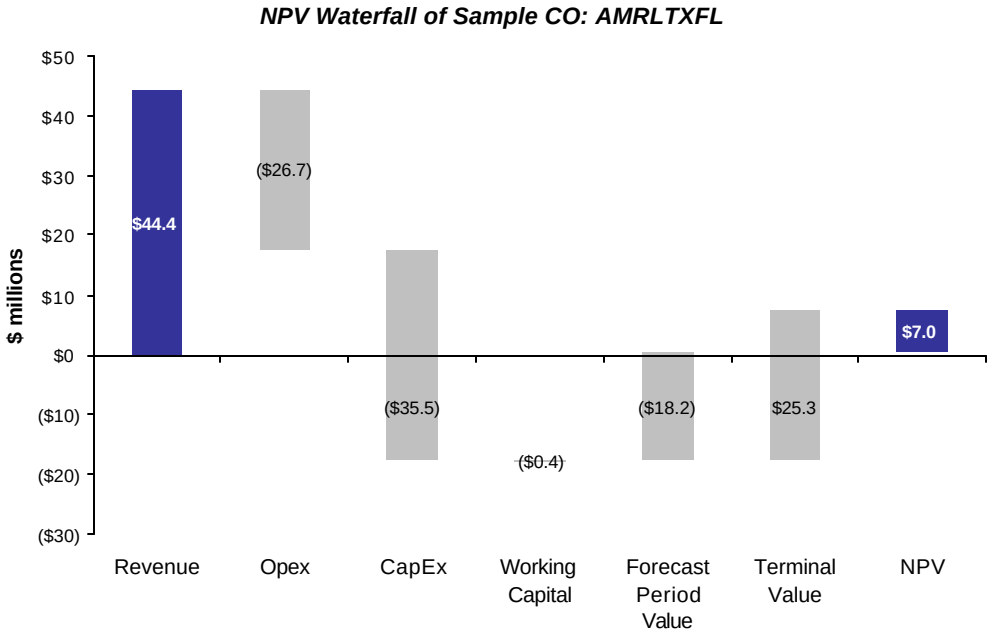
Note: Margins based on benchmarks from Cable MSO and HFC companies

CSMG

In a free market, our analysis shows that this particular CO generates positive free cash flow in year 2 and is cumulative free cash flow positive in year 10; using a 10X EBITDA multiple, this profile yields a positive NPV

- NPV calculations are based on 13% WACC, which reflects a slightly higher cost of capital for this project compared to the ILEC as a whole
- The EBITDA multiple implies a 3% cash flow growth rate in perpetuity. This compares favorably with current cable multiples which are as high as 14X EBITDA





Today's discussion

- Background & Executive Summary
- Analysis Methodology
- Free Market Scenario
- Regulated Scenario
- Conclusions
- Appendix

As we indicated previously, many wirecenters that were marginal in the free market would be financially unattractive under a mandatory UNE regulatory environment

- Out of a total of 117 CO's which have positive NPV in the free-market case, only 15 CO's remain NPV positive under the regulated environment
- These remaining CO's tend to be larger, denser, and wealthier

Location of CO's Which Become NPV Negative in Regulated Environment

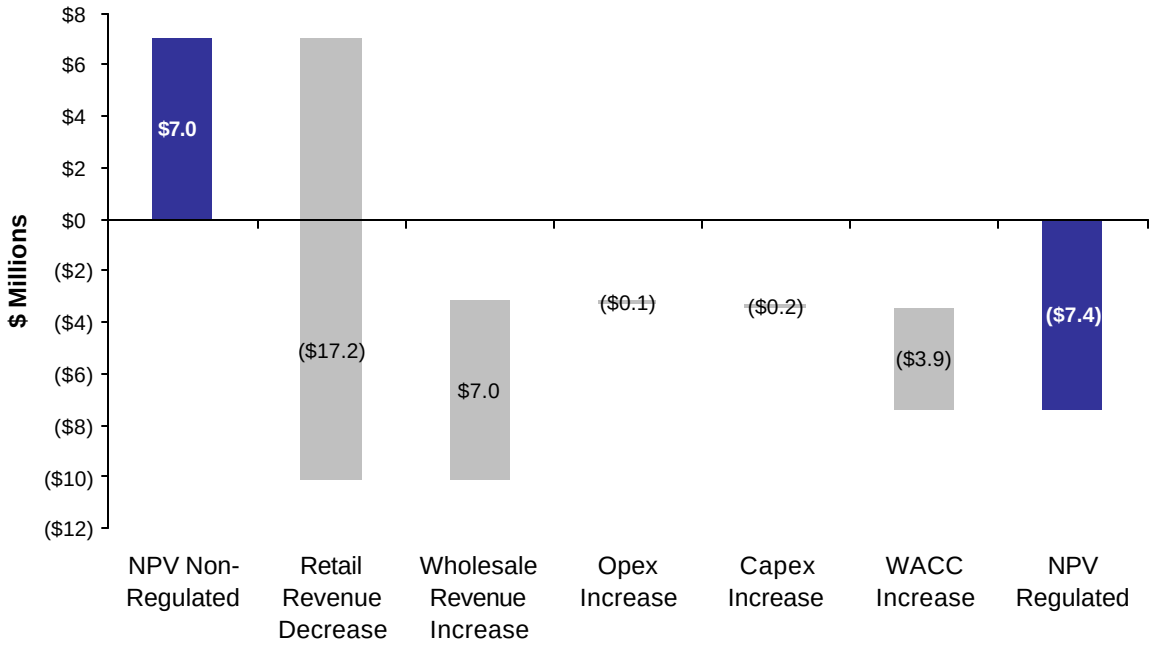
Location	Number of CO's	Total Households
Houston	19	591,195
Dallas	13	353,061
San Antonio	10	342,463
Fort Worth	7	182,393
El Paso	6	145,390
Austin	4	159,692
Corpus Christi	3	79,880
Amarillo	2	60,721
Lubbock	2	64,769
Other	36	908,552
Total	**102**	**2,888,116**

CO's Average Demographics

	Free Market CO Deployment	Mandated UNE CO Deployment
Number of CO's	117	15
Area (square miles)	59	25
Population	80,976	89,783
Households	28,942	33,209
Household Density (Households per square mile)	1,077	1,785
Household Income	$43,990	$52,175
Proportion of Aerial Plant	52%	64%
Proportion of RBOC CO's (Southwestern Bell)	93%	93%

We arrived at this conclusion by examining key cost and revenue differences between the free market and the regulated business cases. By far the largest effect is the lost revenue resulting from mandated UNEs, which is only partially offset by wholesale UNE revenue

NPV: Regulated vs. Non-Regulated
Sample CO: AMRLTXFL



The assumptions behind this analysis are discussed in more detail in the appendix

Key Assumptions in Regulated Scenario

Revenue & Share Assumptions

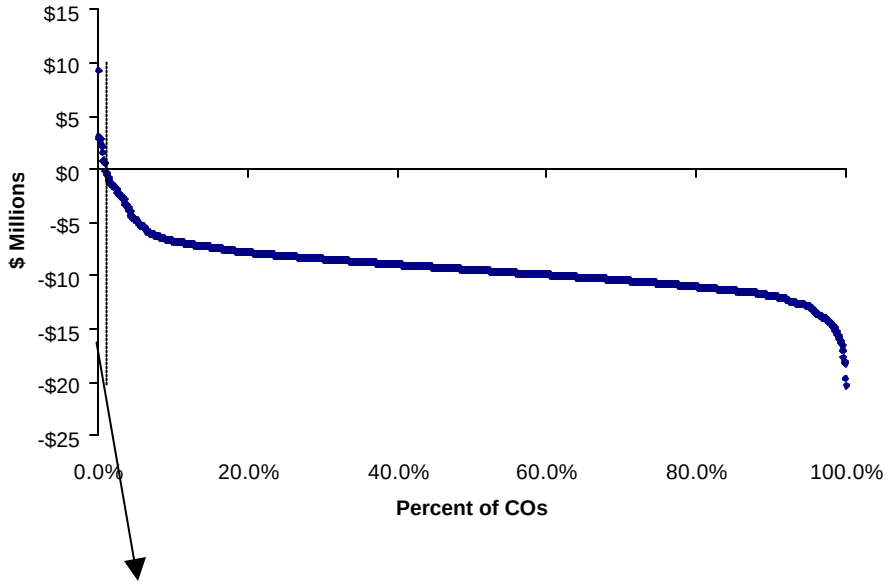
- ILEC voice share loss remains as high as in status quo scenario (assuming new FTTH CLEC competitors)
- UNE FTTH CLECs capture roughly 15% of subscribers (this being the minimum for one or two viable competitors). As a result:
  - ILEC share of data share decreases by 30%
  - ILEC video share decreases by 40%
- Unbundled FTTH UNE loops generate $20 per month of wholesale revenue

Other Assumptions

- WACC increases to 15% from 13% (versus the free market case) to account for increased risk
- CO CapEx increases by 20% to account for interconnection
- Network maintenance expense increase from 3% to 4% of cumulative non-fiber CAPEX

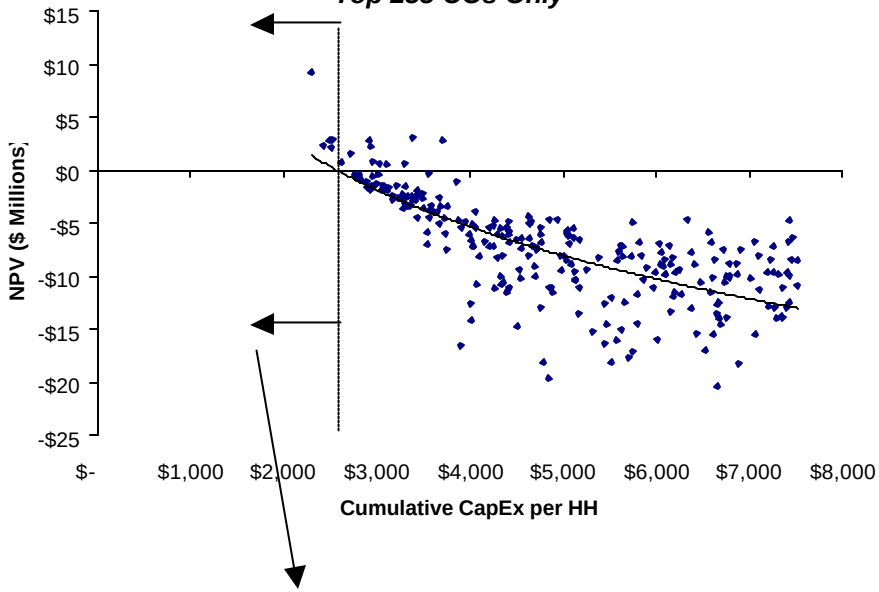
Only the most attractive COs are still NPV positive in the regulated scenario because relatively few COs meet the revenue profile required to recover the FTTH investment

Regulated CO NPV vs. Cumulative % of COs



Only 1% of COs are NPV positive in the regulated scenario

CO NPV vs. Cumulative CapEx per HH
Top 255 COs Only



Under regulation, only the least expensive COs to build are deployed with FTTH

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The fiber to the home market is poised for widespread deployment by a variety of providers. However, the extent to which such deployment actually occurs depends on whether ILEC deployment will be burdened with the cost of unbundling & resale regulation. Our analysis indicates that such regulation will substantially reduce the number of households served by FTTH

- Our modeling and research demonstrates that regulation requiring unbundling would dissuade ILECs from overbuilding their own plant except in very limited circumstances
- Arguably, CLECs could view FTTH deployment as financially viable in either regulatory scenario since their build costs would be similar or better to that of the ILEC and all revenues would be incremental
- However, regulation mandating UNEs and resale of FTTH would provide incentives for CLECs to piggyback on ILEC fiber builds rather than constructing competitive facilities of their own
- While this may result in more competitors (in limited areas), it would also result in a much smaller number of consumers with access to service from an advanced FTTH network

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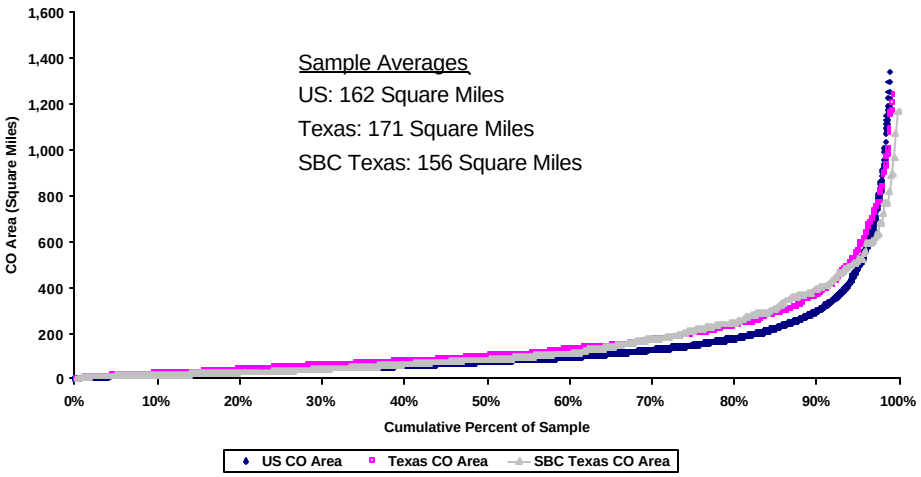
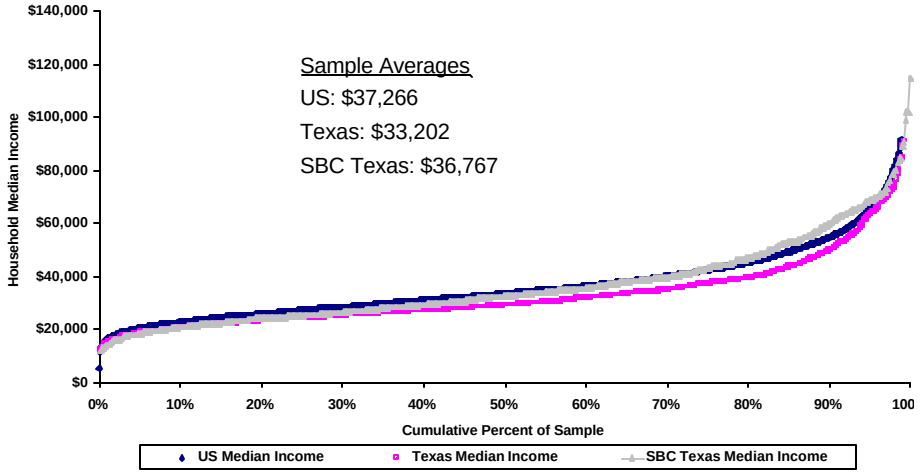
CSMG used all Texas CO's as the sample because Texas acts as a reasonable proxy for the US as a whole

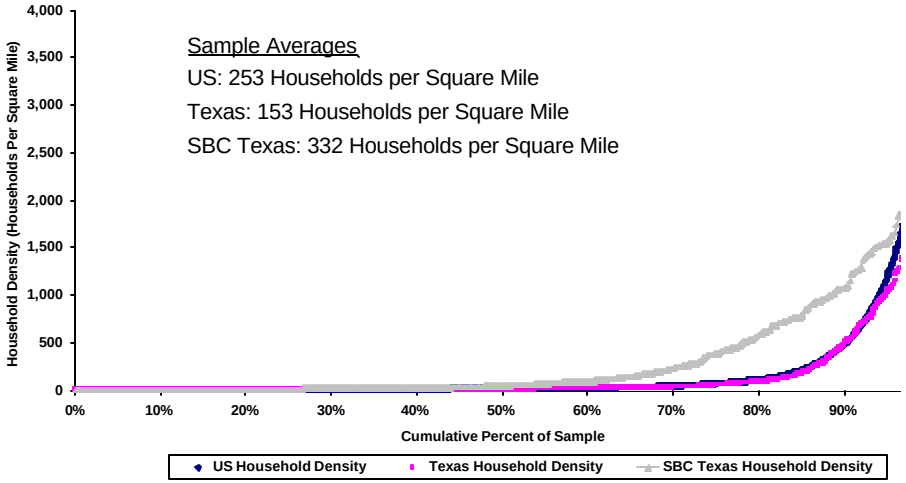
Distribution of CO Area



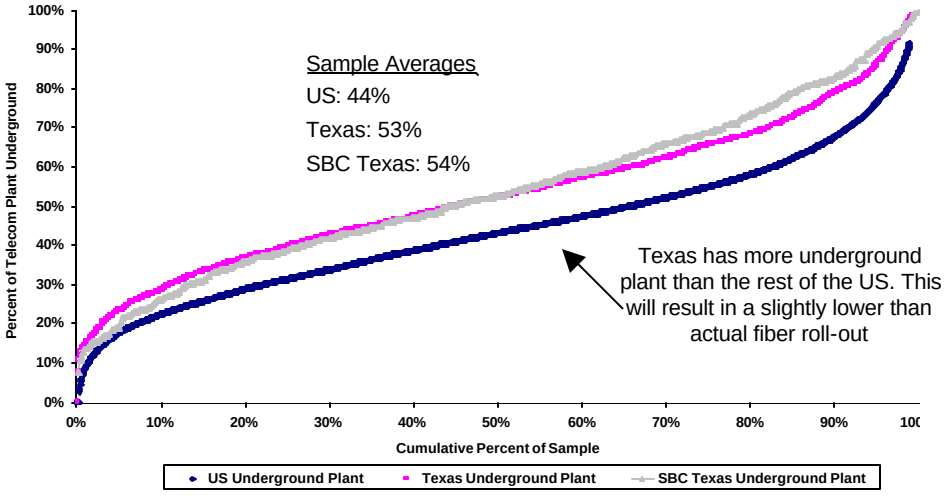
Distribution of Median Income



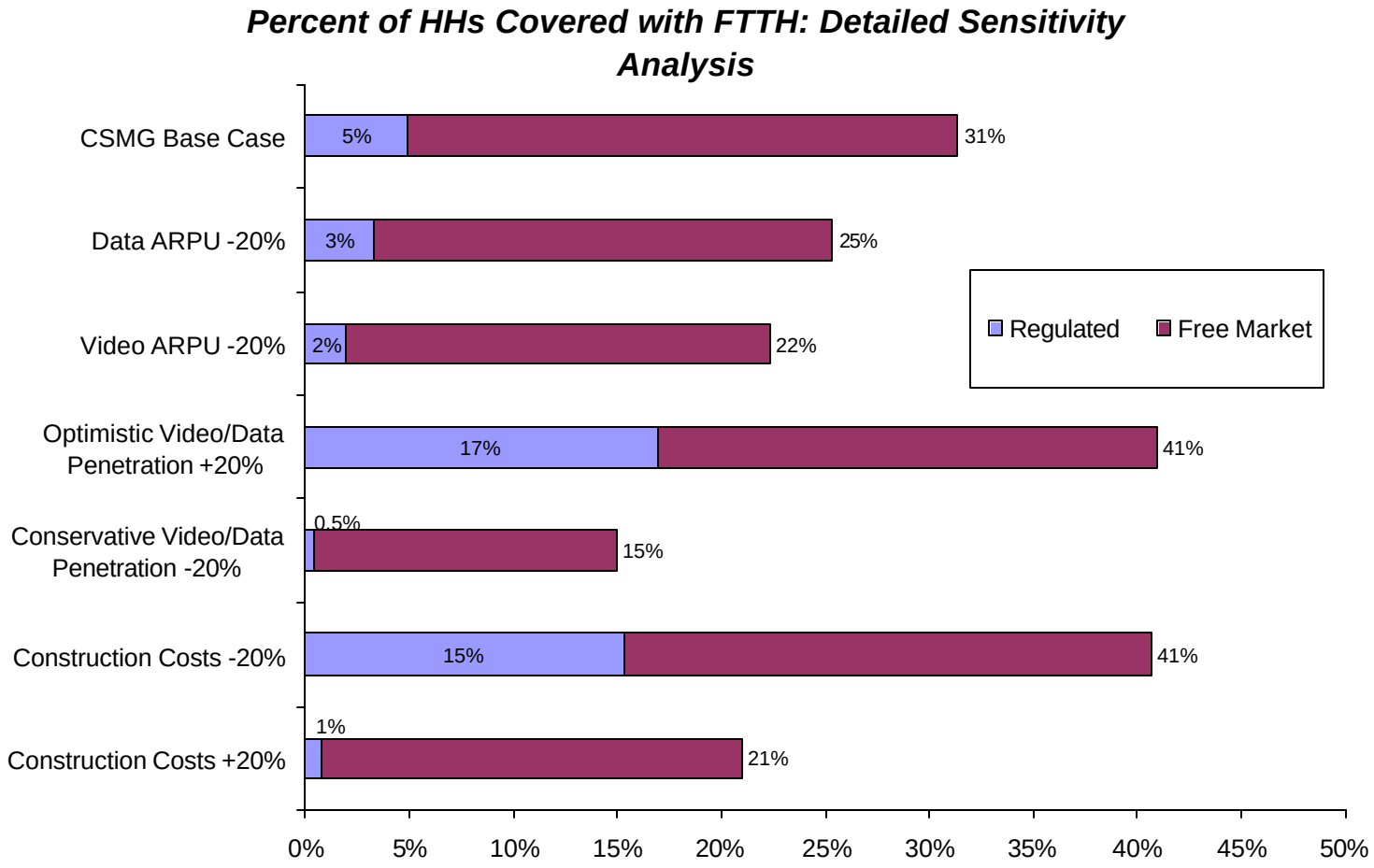
Distribution of Household Density



Distribution of Underground Plant

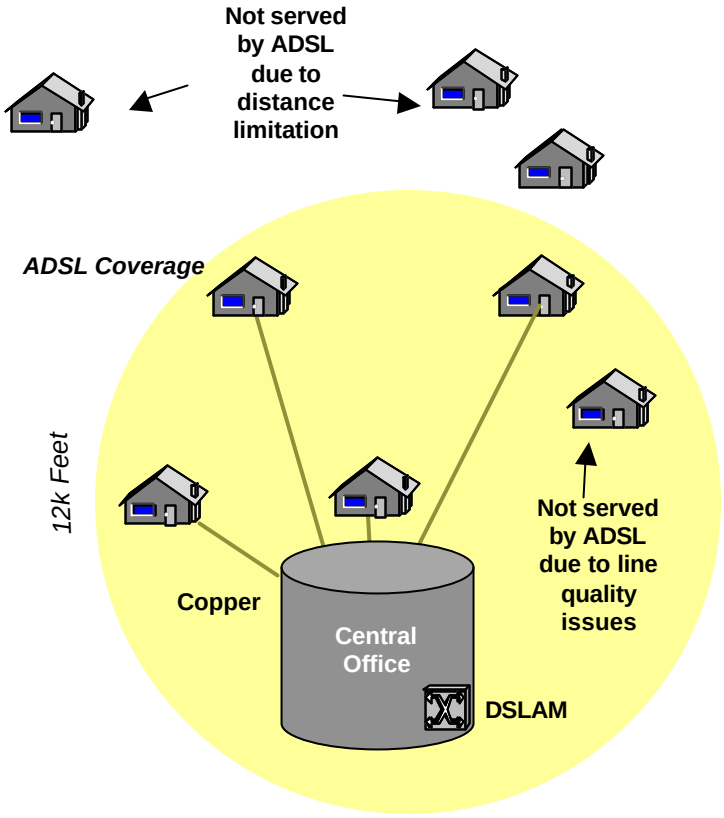


As we indicated previously, the percentage of homes covered by FTTH in both a free market and under regulation is most sensitive to the level of service penetration and the cost of fiber construction. Modeled deployment is less sensitive to changes in ARPU



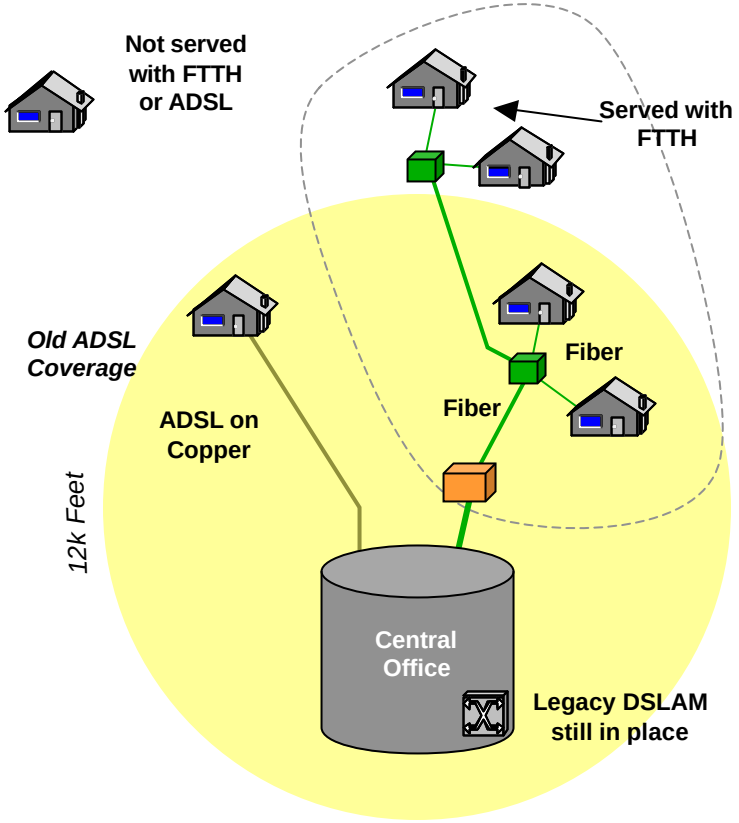
A key consideration in determining the incremental revenue opportunity is the larger number of households that are addressable with high speed data services after deploying fiber to the home

Status Quo



40%-100% addressability depending on CO

Fiber to the Home



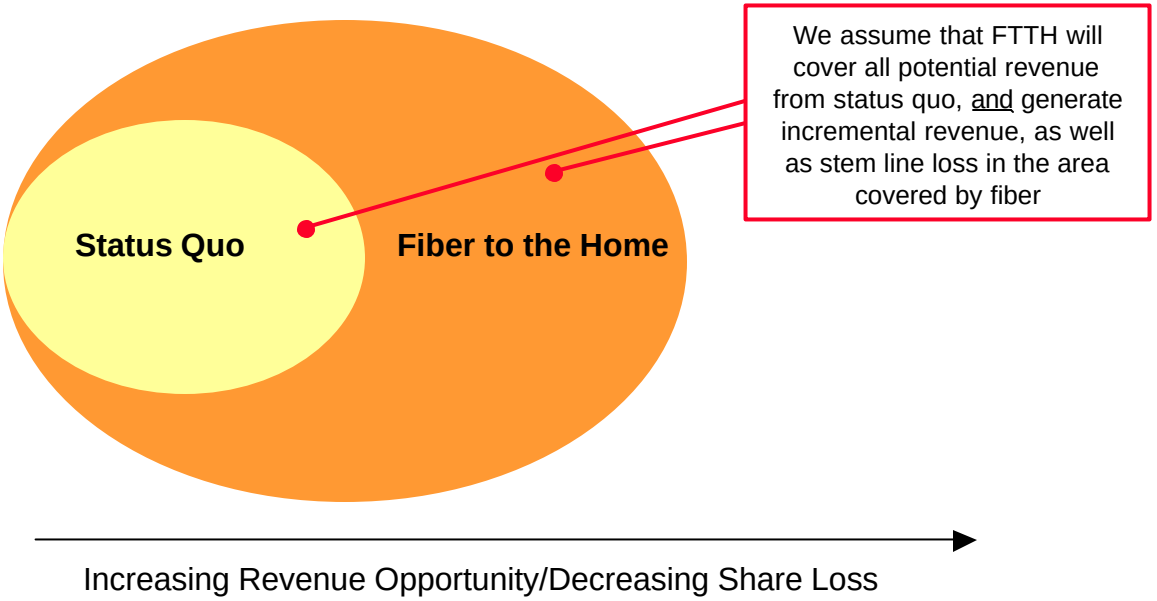
- With FTTH, we assume that all of the old ADSL customers will still be addressable and that some new customers will be covered by FTTH

FTTH addressability is the higher of the old DSL addressability or 60% (based on CSMG optimization benchmarks)

In addition, deploying fiber to the home allows the ILEC to offer a more complete suite of products, creating an incremental revenue opportunity, while providing some defense against encroaching video bundlers

- The increased product offering also acts a defensive strategy to combat share loss to competitors with a bundled video service offering
- However, this comes at the cost of added capital expenditures

Comprehensiveness of Product Offering



Product Offering by Scenario

Status Quo

- POTS voice lines
- ADSL Internet services (<1Mbps downstream, <500Kbps upstream depending on line quality and modem)
- No cable video services

FTTH

- Multiple voice lines (3 POTS lines)
- High-speed Internet (10Mbps, 4.5 Mbps symmetric upstream and downstream), burstable up to 20 Mbps (depending on architecture used)
- Full video CATV service including VOD & HDTV
- Capable of enabling next-generation services including VPN & video conferencing

In order to calculate incremental data revenues for an ILEC overbuilding its own plant as accurately as possible, we disaggregated revenues into three incremental components: 1) increased addressability relative to ADSL, 2) increased share, 3) increased ARPU

Disaggregation of Incremental Data Revenue

Revenue Effect		***Calculation Methodology***		
Addressability Effect *Incremental revenues due to increased data coverage and addressability*	=	*FTTH Data addressability – Status Quo ADSL addressability*	X	*DSL penetration of addressable HHs * Full FTTH ARPU*
Share Effect *Incremental revenues due to higher share of high speed data*	=	*FTTH Data penetration of addressable HHs – Status Quo penetration of addressable HHs*	X	*Addressable FTTH HHs * Full FTTH ARPU*
ARPU Effect *Incremental revenues from higher spending of customers who would have taken ADSL*	=	*Customers who would have taken ADSL in the absence of FTTH*	X	*FTTH ARPU – DSL ARPU*

Our incremental voice revenue stream is built up assuming that attractive FTTH COs will likely face 30% share loss to cable operators in the status quo scenario

- Evidence suggests that cable operators are achieving 25% to 40% telephony penetration of addressable households in areas where they offer cable telephony

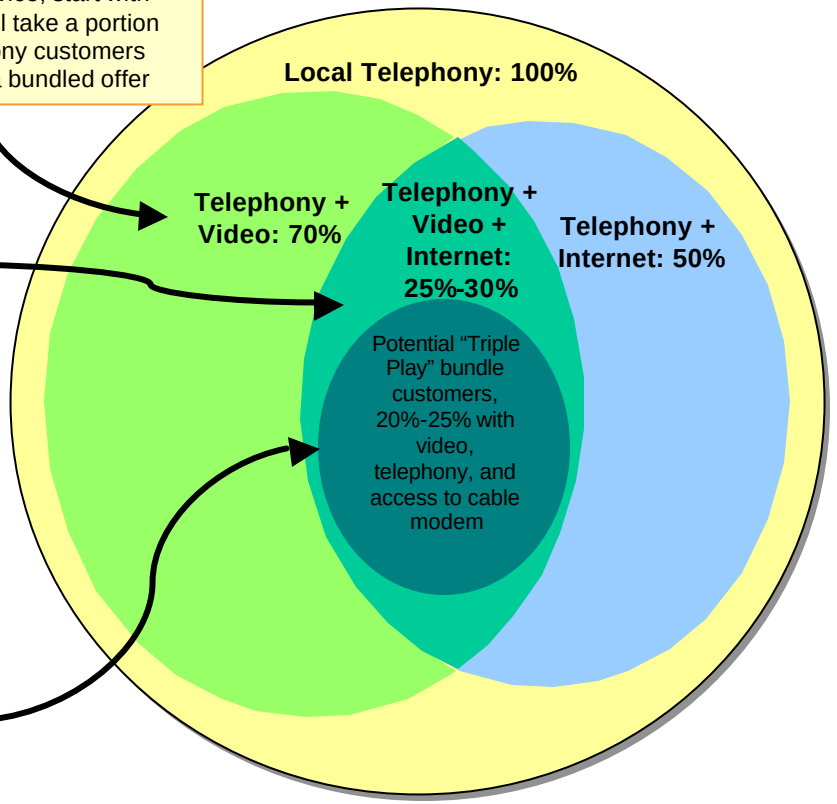
Cable Is a Strong Competitor to the ILECs in the Status Quo Scenario

- Cox has achieved 20% to 25% in certain Omaha and Orange Country, California systems
- Overall, Cox has achieved ~12% cable telephony penetration across all addressable HHs, although this includes recently addressed HHs
- In other mature markets, MSOs have achieved 40% penetration of HHs

Cable providers, with a strong core product in video service, start with great reach: they will take a portion of video and telephony customers from the ILEC with a bundled offer

Cable providers also have a powerful combination (video plus cable modem) that could be uniquely appealing roughly 25% - 30% of households, because they take video services and are Internet subscribers and are telephony subscribers

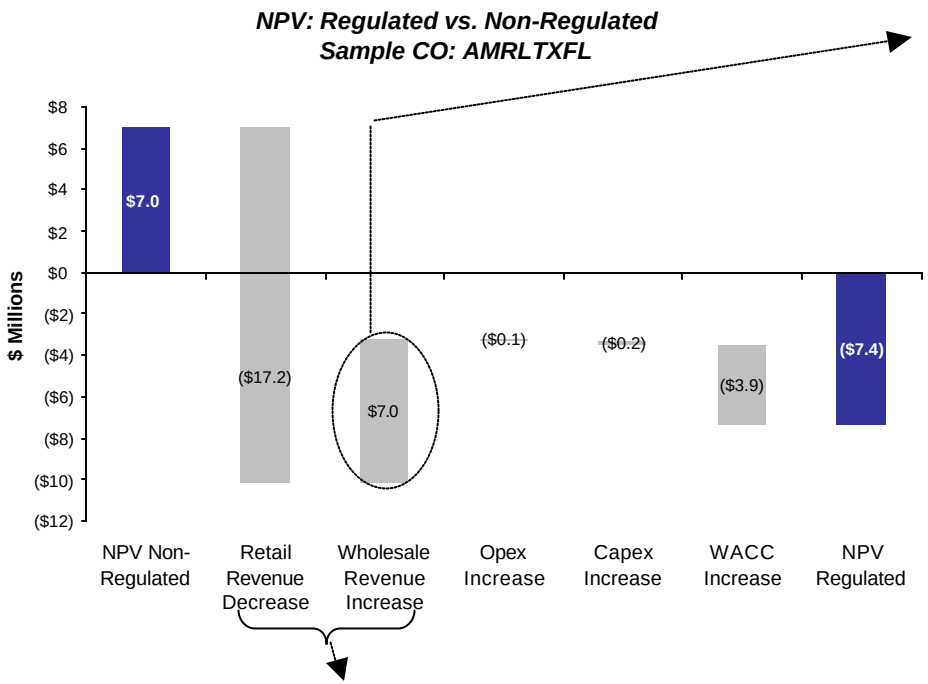
While cable companies can only reach a portion of the potential customers with cable modem service (roughly 75% of Video + Internet Overlap), this 20% - 25% still represents a significant threat to the ILEC



Customers who take combinations of video, telephony and Internet are most vulnerable to cable bundles. CSMG estimates that in the "status quo" scenario, ILEC will lose 30%+ of voice lines to CATV providers in areas where the two compete

Source: Company reports, CSMG analysis

In the regulated case, our wholesale revenue stream is calculated assuming that UNE based CLECs will win customers that take multiple services, but that these CLECs will pay a monthly charge of $20 for each fiber loop connecting a customer location (not each service)



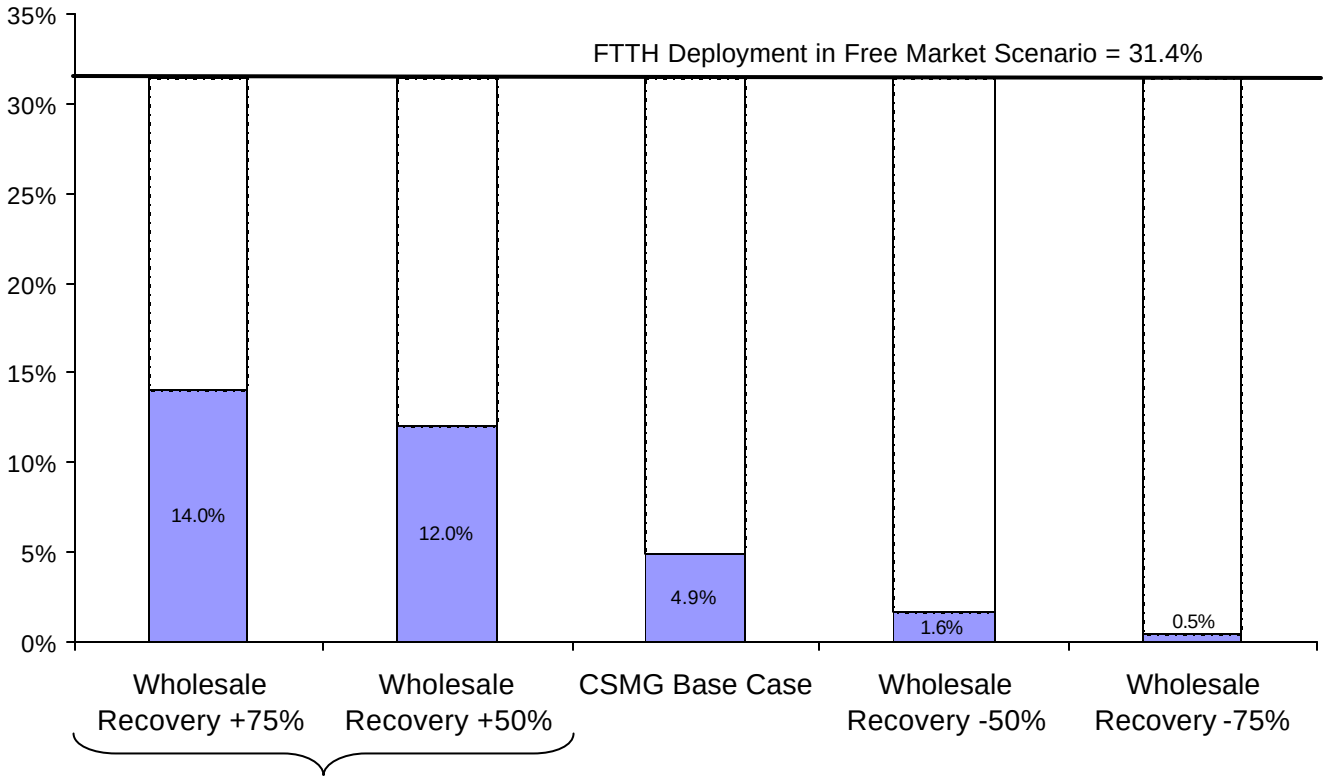
Wholesale Revenue Methodology

- In the regulated scenario we assume a 30% and 40% reduction (percentage, not market share point) in the ILEC share of data and video services respectively
- Because households typically take multiple services, this reduction in service market share corresponds to a 16% FTTH CLEC share of addressable households. In our experience, this market share could allow one or two CLECs to achieve returns high enough to warrant market entry
- Monthly FTTH UNE wholesale line prices are estimated at approximately 1% of cumulative CapEx per household, based on benchmarks for voice UNE-loop in the same range. The average CapEx per household addressed under FTTH is approximately $2,000, making $20 per month a reasonable estimate

In the following slides, we highlight our methodology for revenue reduction and wholesale recovery under regulation in more detail

The level of FTTH deployment under regulation is most sensitive to the expected level of retail share loss to CLECs and the corresponding expected wholesale recovery. Loosening either of these assumptions in favor of the ILEC results in more expected FTTH deployment, but would likely provide insufficient returns for CLEC market entry

Percent of HHs Covered with FTTH Under Regulation: Wholesale Recovery Sensitivity Analysis



- Increasing the expected wholesale ILEC recovery (by increasing UNE rates for example) results in more FTTH deployment under regulation than in the base case, but this may not provide sufficiently attractive returns for CLEC market entry (i.e., they would be earning lower margins on their services)
- Even if CLECs do take advantage of FTTH UNEs in this scenario, significantly fewer homes would be covered with FTTH facilities than in a free market

- In our view, it is unlikely that UNE-P unbundling (which is not directly addressed in this study) would significantly increase the number of HHs covered with FTTH
- The large majority of FTTH deployment costs are in the construction of the fiber facilities. Unbundling the remaining elements would therefore increase FTTH UNE-L costs by only a small amount

Free market revenue assumptions were built from a combination of third party sources, interviews, and CSMG benchmarks…

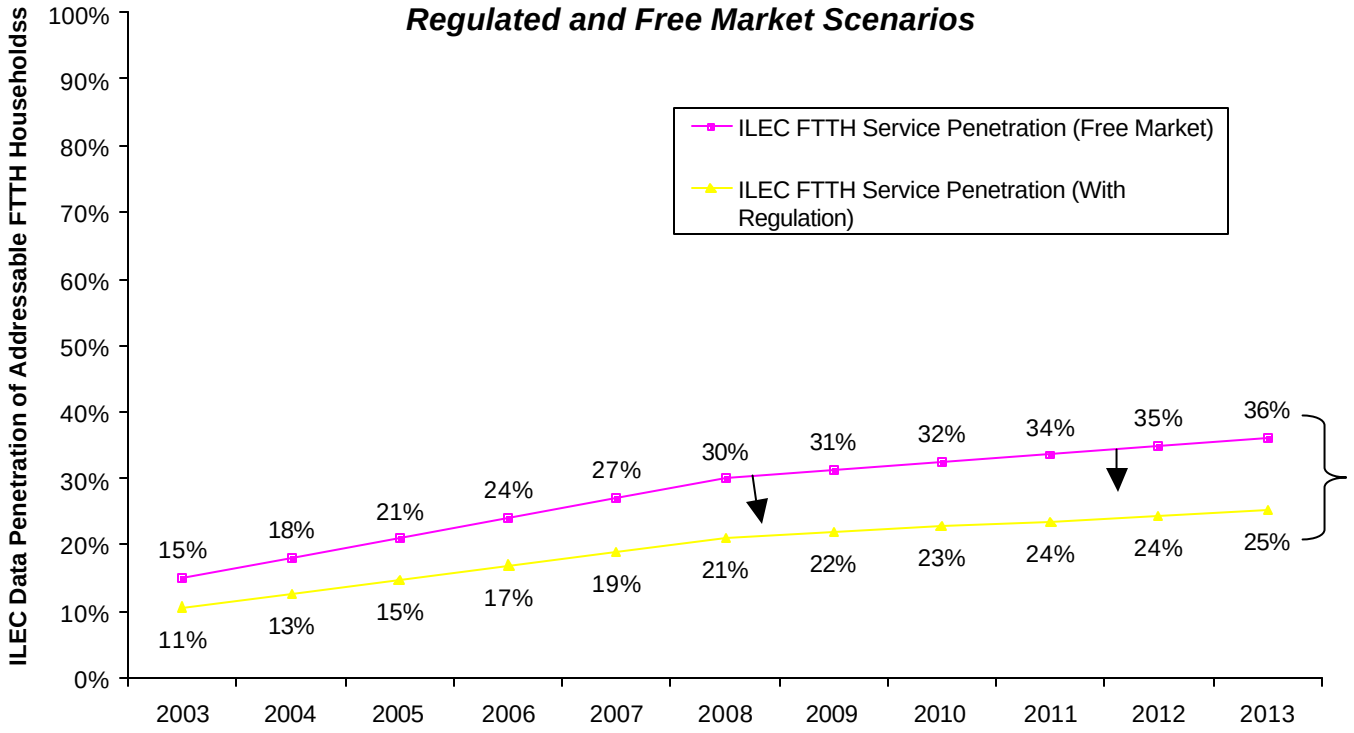
	Assumption	*Rationale*
Free Market Revenue Assumptions	• ILEC losses 23% of voice lines to competitors by 2013	• Cable has won 30-35% share of telephony subscribers in areas where the voice service is offered • We anticipate a high overlap between these areas and those in which FTTH can be economically viable. Therefore, voice share loss in the status quo (34% by 2013) is primarily driven by expected cable upgrades over time in the absence of FTTH deployment • In the FTTH scenario, we assume that share loss is less intense than in the status quo, since the ILEC can now counter the bundled service offerings of the cable companies
	• ILEC achieves 36% data penetration of addressable HHs by 2013	• In the status quo, we assume that legacy DSL would have a 40% share of the 65% of addressable homes that take high speed data by 2013 (based on current DSL market shares and extrapolations of 3rd party forecasts) • As the FTTH product will be superior to competing platforms, we assume that it cannibalizes100% of forecasted DSL subscribers, and gains share from competing platforms, increasing total share of broadband subscribers to 55% in the FTTH base case (or 36% of homes passed, holding broadband penetration constant at 65%)
	• ILEC achieves 40% video penetration of addressable HHs by 2013	• We forecast 85% penetration of pay video services (including DBS) in 2013, up from about 75%in 2003 (Kagan Associates, Merril Lynch). Our FTTH video penetration forecast is based on the ILEC being able to capture about 45% of all pay video subs in 2013. • We feel that, given the ILECs' ability to capture 40-45% of LD share quickly from the IXCs and the advanced features (VoD, etc) enabled by FTTH, it is reasonable to assume that the ILECs will capture significant share but never quite reach parity with the cable companies. This is also roughly the level of video penetration previously targeted by HFC overbuilders, and the level of share ILECs have achieved in consumer broadband
	• ILEC achieves 26% penetration of "other"services into addressable households by 2013	• "Other" services in our model include future offerings such as video conferencing and VPN, as well as possibly recurring fees to recoup CPE costs • Based on the prevalence of value added services in the voice world today, as well as the willingness of consumers today to pay for "other" fees in the current video world (set-top box fees, TV guide, remote, digital service fees, etc.), we feel that 65% of households that take FTTH will take "other" FTTH services in 2013, up from 15% in 2003

Regulated assumptions were primarily based on our experience and informal discussions with ILECs

	Assumption	Rationale
Regulated Revenue Assumptions	• ILEC losses 34% of voice lines to competitors by 2013 (same as regulated scenario)	• Under regulation, we expect that FTTH UNE CLECs will capture any share that would have been regained in a free market, resulting in the same share loss as the status quo scenario
	• ILEC achieves 25% data penetration of addressable HHs by 2013	• We forecast that CLECs will be effective at selling multi-service bundles • Based on our experience, one or two CLECs would together require about a 15% share of subscribers to be economically viable • A 30% reduction in data subs and data share is equivalent to a 40% reduction in the number of video subs assuming the high level of mulit-service bundling we anticipate • These two penetration reductions result in a 16% market share for FTTH CLECs
	• ILEC achieves 24% video penetration of addressable HHs by 2013	
	• ILEC achieves 16% penetration of "other"services into addressable households by 2013	• 65% of ILEC FTTH customers are assumed to take other services in 2013, just as in the free market scenario. The difference in "other" service penetration stems directly from the lower ILEC market share in this scenario
	• $20/month of wholesale revenue per unbundled FTTH loop	• Monthly UNE wholesale voice line prices are approximately 1% of cumulative CapEx per household (voice UNE-loop is typically in the same range today). The average CapEx per household addressed under FTTH is approximately $2,000, making $20 per month a reasonable estimate
Regulated Cost and Financial Assumptions	• Fixed costs of CO equipment increase 20% under regulation	• Incremental CapEx will be required to interface with CLEC voice and data equipment in a regulated scenario. • Based on interviews with ILECs, we feel a 20% increase in the cost of CO equipment (approximately $40,000 per CO) is a reasonable estimate of incremental interconnection expense
	• Weighted Average Cost of Capital (WACC) increases from 13% to 15% under regulation	• A 13% WACC would be appropriate for a relatively risky project within an ILEC • Under regulation, the increased uncertainty of returns to FTTH investment requires an increased WACC to the levels seen in CLEC or HFC business cases
	• Network maintenance costs increase from 3% to 4% of cumulative non-fiber CapEx under regulation	• Under regulation, it will be necessary for the ILEC to have additional network personnel on hand to interface with the CLEC network. The incremental cost of this will not be overwhelming, but noticeable, so a percentage point increase is representative

In a free market scenario, we assume that 36% of homes passed with FTTH eventually sign up for data service with the ILEC, versus only 25% in a regulated scenario. We see a very high-bandwidth data service priced at a small premium to DSL as the most differentiated product in the FTTH service bundle

Baseline ILEC Data Penetration of Addressable Households in Regulated and Free Market Scenarios

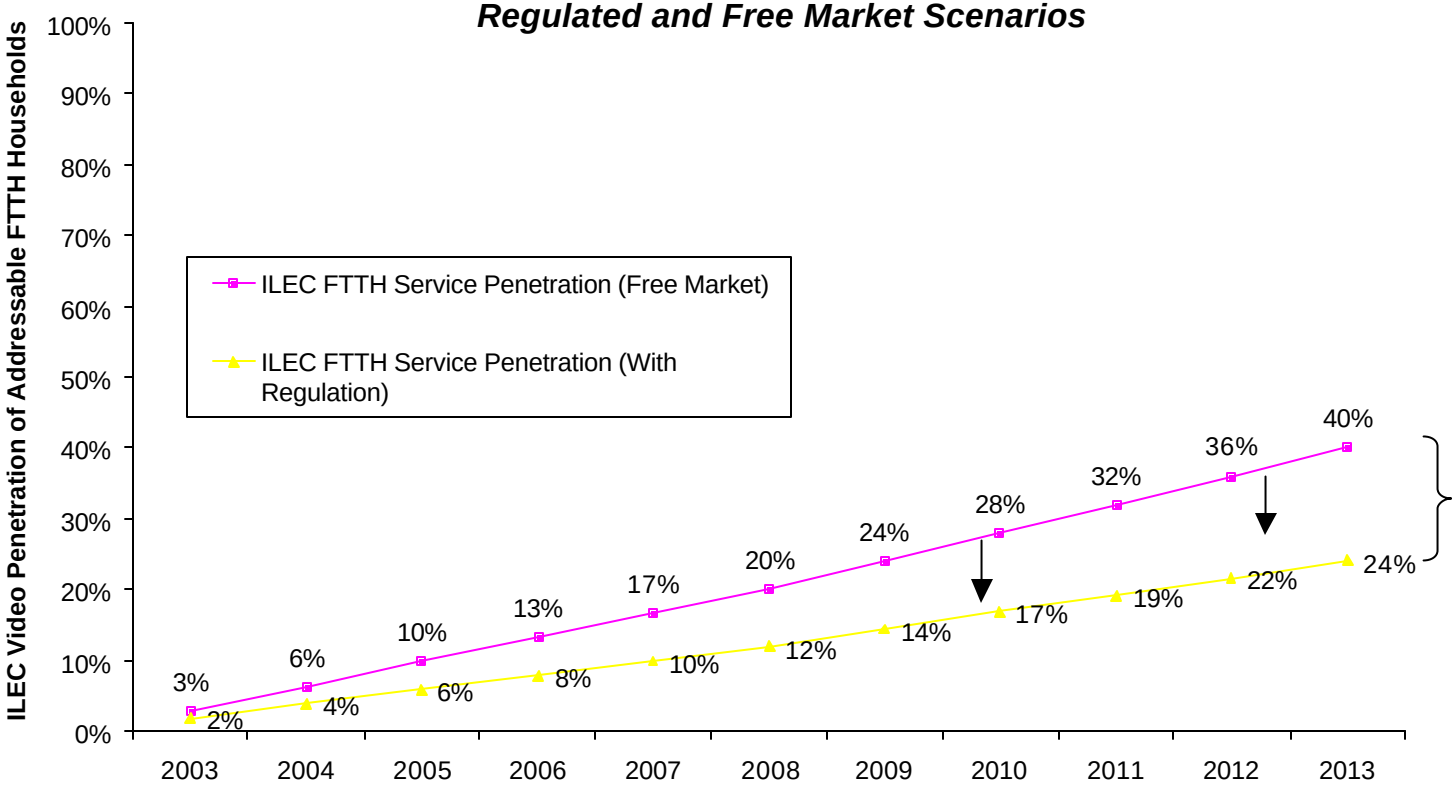


- On average, we assume that the ILEC eventually sells FTTH data services to 36% of addressable households. Data penetration scales in each CO according to HH income
- This is based on roughly 65% of addressable households taking a high speed data connection in 2013, with a 55% ILEC share of broadband connections in 2013
- In a regulated scenario, share reverts to DSL status quo levels of 40% rather than 55% under free market conditions, resulting in 25% data penetration

Source: IDC, MSDW, CSMG analysis

We anticipate that FTTH video pricing will be competitive with digital cable and DBS, while offering true VoD. We forecast that 40% of addressable homes will take video service from the ILEC, falling to 24% in the regulated case

Baseline ILEC Video Penetration of Addressable Households in Regulated and Free Market Scenarios

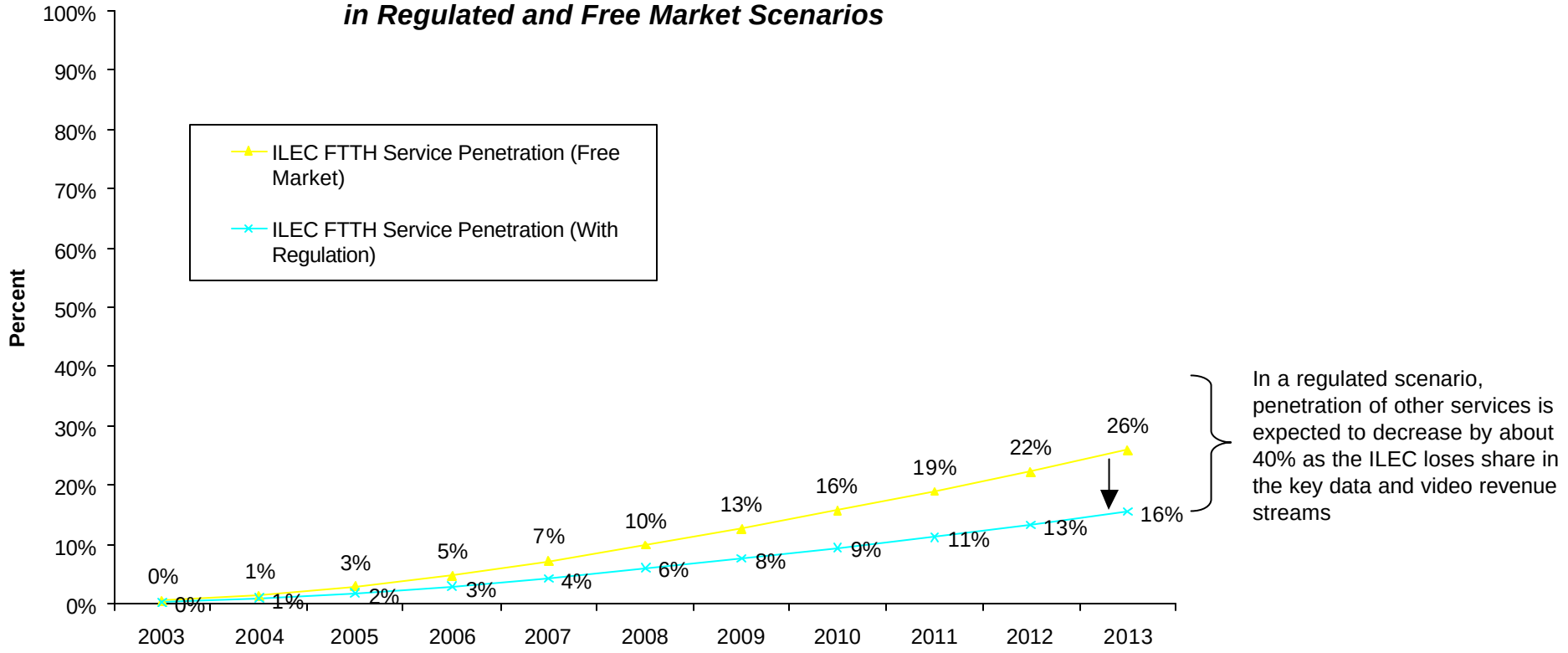


- We assume that the ILEC eventually captures 40% of addressable video households. This is roughly a 45% market share of video in 2013, assuming that around 85% of homes will use pay video services
- Service penetration ramps more slowly than for data because video subs need to be won from cable and DBS
- CLECs will most likely try to compete on video price, which will result in a 40% reduction in ILEC video market penetration (to roughly 30% video market share)

Source: IDC, MSDW, CSMG analysis

In a free market, we assume that penetration of other services (including VPN, video conferencing services, and any recurring equipment fees) will increase slowly to 26% of addressable homes in 2013. In a regulated scenario, this will drop to 16% as competitors take video and data share from the ILEC

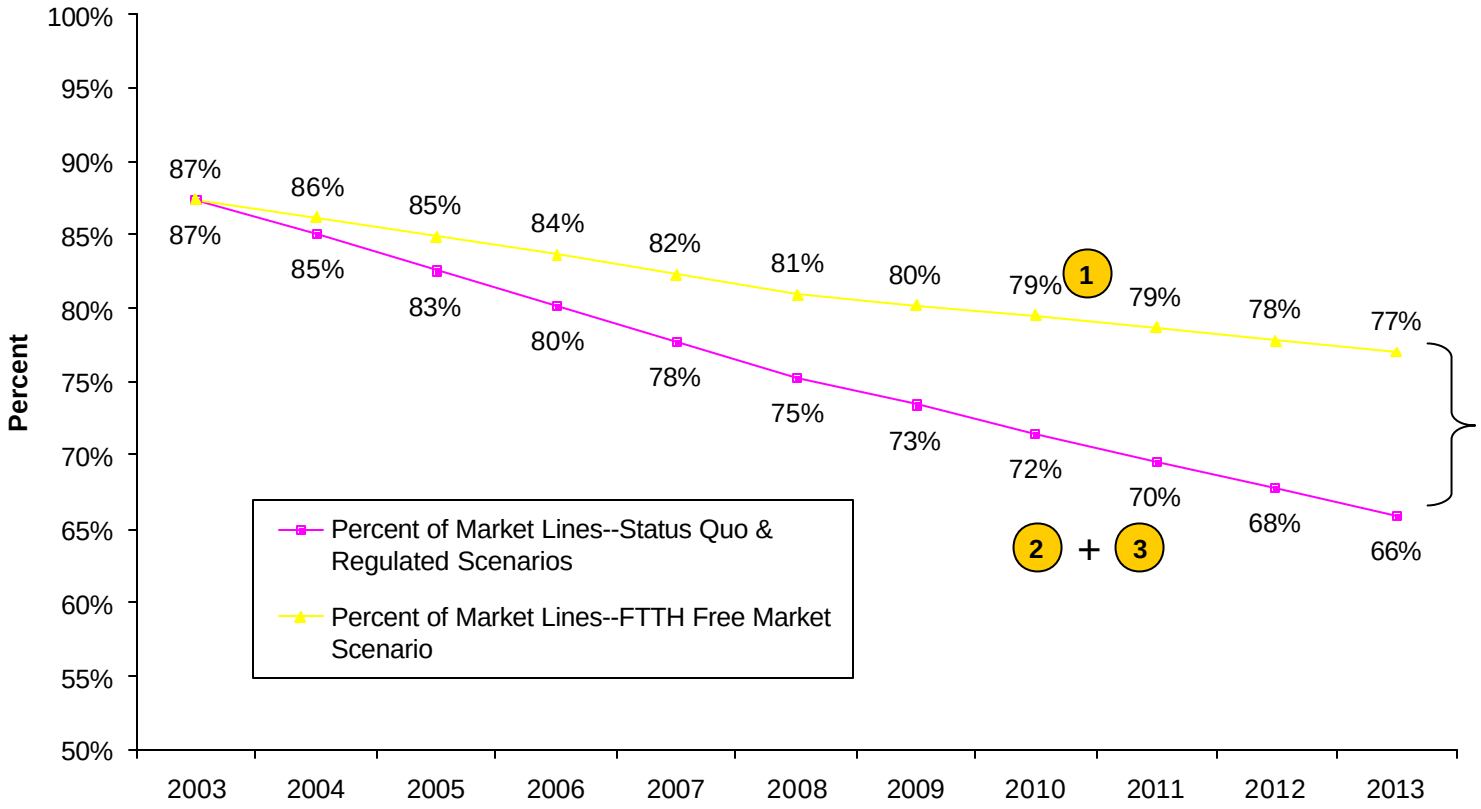
Baseline ILEC Other Services Penetration of Addressable Households in Regulated and Free Market Scenarios



Source: Kagan & Associates, CSMG analysis

Incremental voice revenues contribute only a small amount of revenues to the ILEC FTTH business case, since only revenue from lines that would have been lost in the status quo but are retained in a FTTH scenario are counted. We assume that any voice share loss in a regulated FTTH scenario is the same as the status quo

Baseline ILEC Penetration of Voice Lines in FTTH Addressable COs

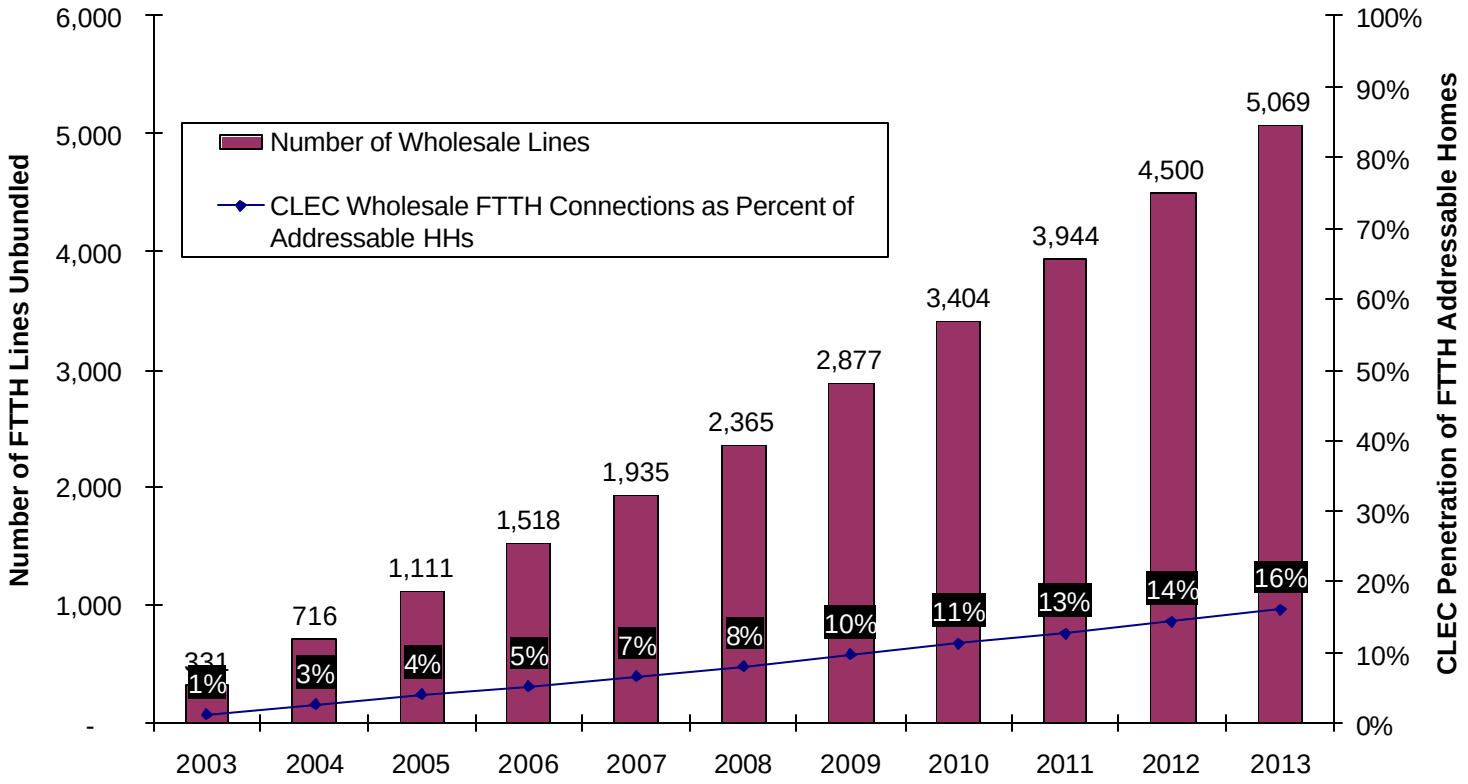


1. In the status quo scenario, we assume that the ILEC will lose significant voice share over time to bundled service competitors and UNE CLECs
2. In our base free market scenario, we assume that FTTH allows the ILEC to effectively compete against telephony bundles, allowing it to reduce forecasted line loss
3. In our regulated scenario, we assume that any share that would have been regained in the free market FTTH scenario is lost to new UNE based CLECs

Source: FCC, MSDW, CSMG analysis

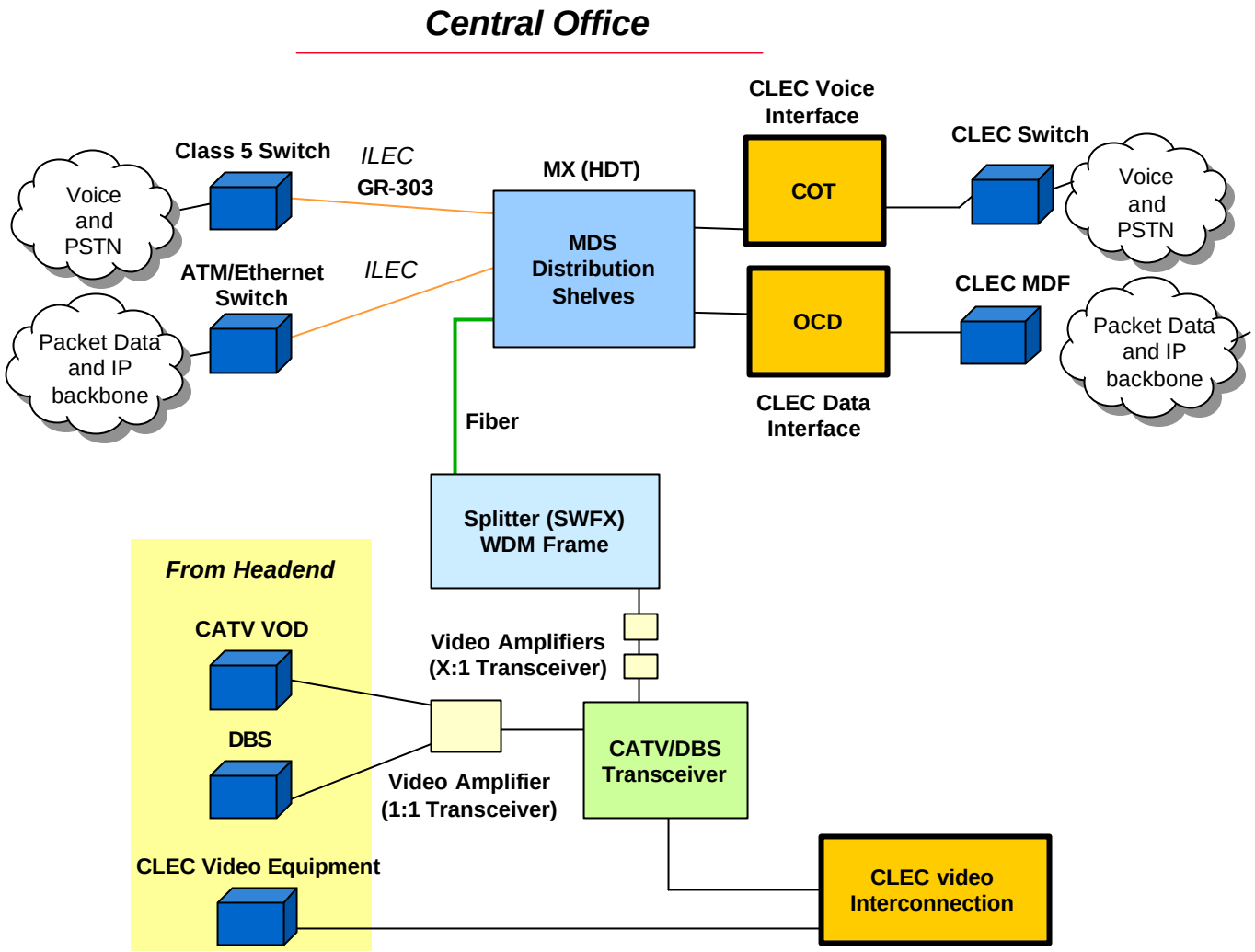
Since CLECs will try to bundle as many services together as possible in the regulated scenario, we assume that the forecasted share loss in voice and video services will correspond to an aggregate 16% CLEC penetration of addressable homes. These connections generate $20 of UNE wholesale revenue per month for the ILEC

FTTH Lines Unbundled for Competitors and Competitor Penetration of Addressable Homes



Source: CSMG analysis

The ILEC must undertake specific capital expenditures in the CO to interconnect with a CLEC in the FTTH scenario. Separate equipment is required for voice, data and video products



Competition Assumptions

- The ILEC must undertake some capital expenditures to provide for interconnection if a CLEC requests unbundling
- CSMG estimates that this will add approximately 20% ($40,000) to the fixed costs of installing FTTH equipment in the CO

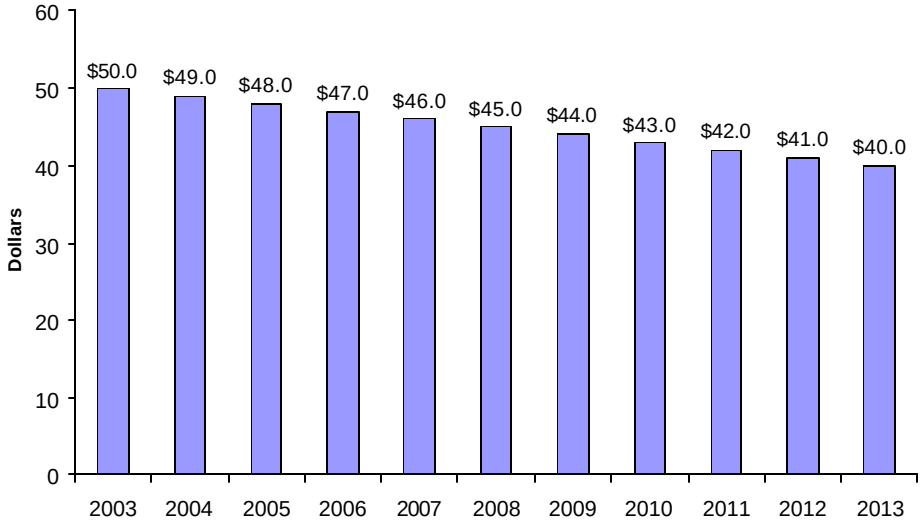
Key

New or more expensive capital elements required in competition

Source: CSMG Interviews and Analysis

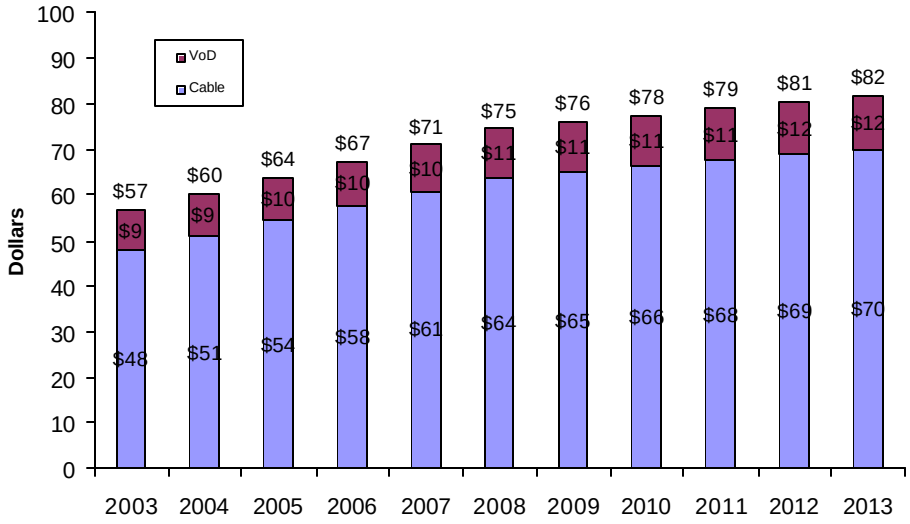
We forecast that data average revenue per user (ARPU) will fall to $40 in 2013 as internet backbone costs continue to fall, throughput rates increase, and competitors offer discounts. At the same time, video ARPU is expected to increase as households take up pay digital video and VOD services

Average Monthly Data Revenue Per User
Sample CO: AMRLTXFL



- Data ARPUs will decline as Internet backbone costs fall and CATV providers cut prices to compete with FTTH
- At the same time, high speed data penetration rates are expected to increase significantly

Average Monthly Video Revenue Per User
Sample CO: AMRLTXFL



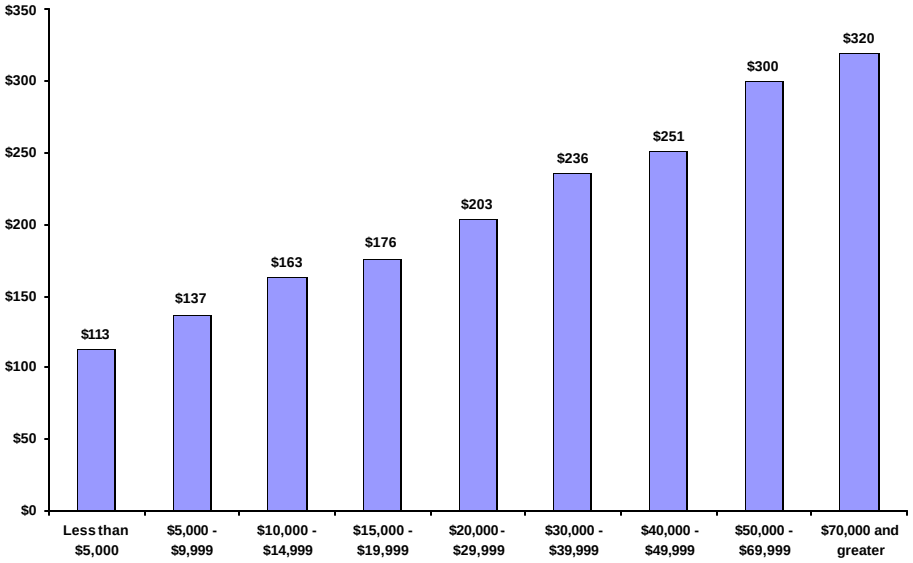
- Video ARPUs will continue their historical growth rate as more households take up digital video, PPV and VOD services, until 2008, at which point ARPU is expected to increase at a slower rate (matching increases in programming costs)

Source: MSDW, Kagan & Associates, CSMG analysis

We employed a similar methodology in order to determine model inputs that scale video spend and data penetration by household income for each CO

Video Spend Scalar

Annual Household CATV Spend By Income Group

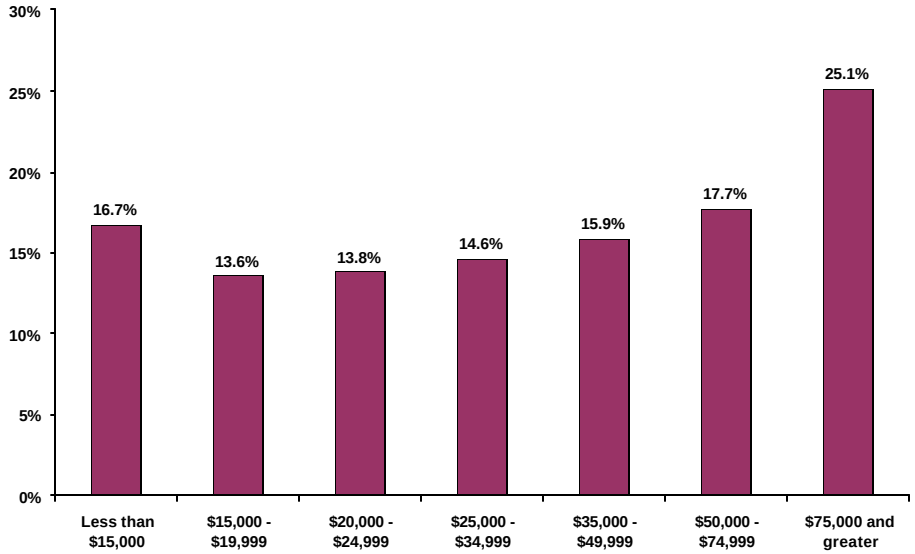


- Annual spending on cable and community TV from the Bureau of Labor Statistics 1998 Consumer Expenditure Survey, as shown in the chart above, was initially regressed against an estimate of the median point of each income bracket
- From this first regression, an initial scalar was developed which showed variation in video spending for each bracket in relation to the spend level of a household with average US household income of $37,000
- These original scalars were then regressed against household income in order to quantify a model input which would scale up current average video spending by the variation in average household income of an individual CO to the national average

Source: 1998 BLS Consumer Expenditure Survey quoted in FCC paper

Broadband Data Penetration Scalar

US Households With High-Speed Internet Access By Income 2001



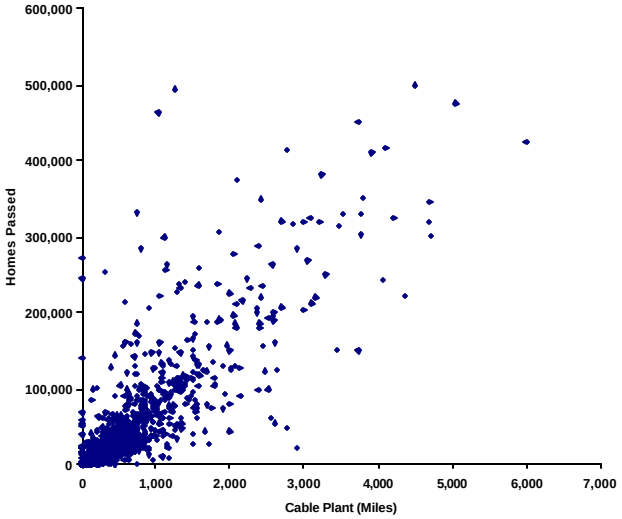
- Penetration rates of high-speed Internet access services, as shown in the chart above, was initially regressed against an estimate of the median point of each income bracket
- From this first regression, an initial scalar was developed which showed variation in broadband penetration for each bracket in relation to the penetration level of a household with average US household income of $37,000
- These original scalars were then regressed against household income in order to quantify a model input which would scale up current average broadband penetration by the variation in average household income of an individual CO to the national average

Source: National Telecommunications and Information Administration, 2001

CSMG employed a three-step methodology in order to quantify the amount of cable plant required on an individual CO basis…

1. Assess Relationship Between Plant and Homes Passed

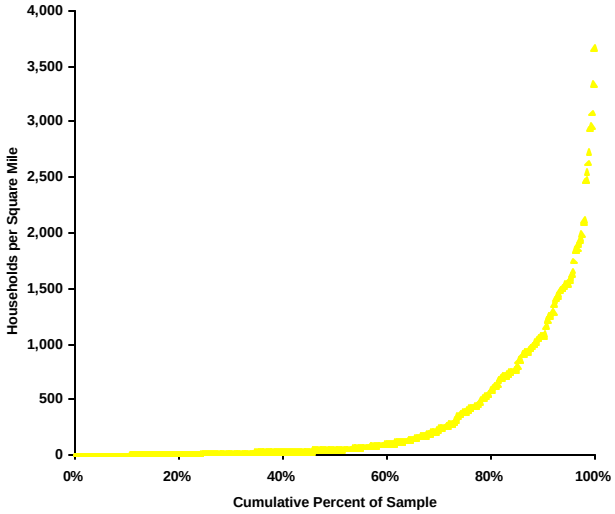
Total Cable Plant vs Homes Passed



- Cable System data is available from Warren's 'Television and Cable Factbook for over 7,000 cable franchises in the US. Data for each franchise includes geographical location, homes passed, subscribers, and total plant
- A regression was performed to calculate the relationship between the two variables
- The regression coefficients were used as inputs to estimate the amount of plant required on a CO level for the FTTH build-out

2. Adjust for Variation in Household Density of CO

Household Density of CO Sample



- The regression outputs from step (1) do not take into account variations in household density for individual CO's
- To adjust for this, the number of households within 12 kilofeet of the CO is used as the input to determine the amount of required plant, based on the regression coefficients estimated in step (1), rather than the total number of households
- This approach is also consistent with the notion of attempting to optimize the CO rollout ie addressing the most attractive households

3. Determine Plant Split Between Aerial/Underground & Feeder/DA

Sample Plant Requirements By CO

CLLI Code	City	Total Plant Required (miles)	Total Plant Underground	Total Plant Aerial	Total Plant in Feeder	Total Plant in DA
ABLNTXOR	ABILENE	148	112	35	44	104
ABLNTXOW	ABILENE	185	83	102	54	130
ABRYTXGI	AUBREY	109	35	74	32	77
ADVLTXAV	ADAMSVILLE	447	255	192	132	315
AGTNTXDA	ANGLETON	165	64	101	48	116
AGTNTXTI	ANGLETON	141	56	86	42	100
ALBYTXPO	ALBANY	1,286	862	424	379	907
ALICTXAL	ALICE	174	99	75	51	123
ALLNTXSA	ALLEN	129	16	113	38	91
ALPITXAP	ALPINE	436	255	181	129	308
ALSNTXAL	ALLISON	3,174	1,833	1,341	935	2,239
ALVDTXTI	ALVARADO	111	29	82	33	79
ALVNTXAL	ALVIN	169	52	117	50	119
AMRLTX02	AMARILLO	147	124	23	43	104
AMRLTXDI	AMARILLO	220	138	81	65	155
AMRLTXEV	AMARILLO	172	124	49	51	121
AMRLTXFL	AMARILLO	284	131	153	84	200
AMRLTXOS	AMARILLO	102	21	81	30	72
ANNATXWA	ANNA	113	38	75	33	80
ANSNTXAN	ANSON	198	128	71	58	140
ASTNTXAS	ASHERTON	173	97	76	51	122
ATLNTXSW	ATLANTA	165	74	91	48	116
AUSTTXBC	AUSTIN	88	16	73	26	62
AUSTTXBE	SPICEWOOD	118	31	87	35	83

- Plant capital costs in a FTTH scenario will vary not only by the total amount of plant required, but also on the splits between underground and aerial build, as well as the proportion between feeder and Distribution Area (DA)
- To estimate the total amount of underground plant, we used percentage of housing stock served by each individual CO built since 1970
- To estimate the total amount of Feeder/DA plant we used the average ratio calculated in previous CSMG studies for ILEC build-outs

Source: Kagan's Cable Handbook, Warren's Television & Cable Factbook, CSMG Analysis

CLECs are setting the pace in FTTH deployments

	Service Provider	Location	Current Subscribers	Current Homes Passed	Status	Technology
CLECs	Greenfield Communications	Fullerton, CA	0	0	Announced	PON
	WinFirst	Sacramento, CA	100	100	Live	Gigabit Ethernet and HFC
	LPGA International	Daytona Beach, FL	10	10	Under Construction	APON
	Bear Creek subdivision	Meridian, ID	10	10	Live	Gigabit Ethernet
	Conxxus LLC	Central Illinois (rural)	0	100	Under Construction	Gigabit Ethernet
	Nex-Tech	Almena & Norton, KS	650	650	Live	APON
	Hometown Solutions	Morris, MN	200	200	Live	APON
	Evermoor	Rosemount, MN	10	10	Live	APON
	Daniel Island Media Co.	Daniel Island, SC	800	800	Live	APON
	Eagle Broadband	Austin & Houston, TX	10,000	24,000	Live	PON
	Central Texas Technologies	Leander, TX	10	10	Live	PON
	Broadlands	Loudoun County, VA	0	0	Under Construction	APON
	Landsdowne on Potomac	Leesburg, VA	8	8	Under Construction	APON
	Guthrie, IA	Guthrie, IA	100	100	Live	APON
Small ILECs	Roseville Telephone	Roseville, CA	300	300	Live	APON
	Rye Telephone Co.	Colorado City, CO	200	200	Live	APON
	The Huxley Cooperative Telephone Company in Central Iowa	Huxley, IA	100	100	Live	APON
	Blair Telephone Co., Huntel Engineering	Blair, NE	50	50	Live	FTTC moving to ATM
Municipalities	City of Palo Alto Utilities	Palo Alto, CA	70	70	Live	PON
	Holland BD of Public Works	Holland, MI	0	0	Under Construction	APON
	Borough of Kutztown, PA	Kutztown, PA	0	0	Under Construction	APON
	Provo City Power	Provo, UT	0	0	Under Construction	Gigabit Ethernet
	Bristol VA Utilities	Bristol, VA	0	0	Announced	APON
	Grant County Public Utility District	Grant County, WA	1,800	6,000	Live	Gigabit Ethernet
	Chelan County Public Utility District Networks	Chelan County, WA	300	687	Live	PON
RBOCs	SBC	Mission Bay, CA			Announced	APON
	BellSouth	Dunwoody, GA	400	400	Live	APON
	Verizon	Brambleton, VA			Announced	PON

Totals		
CLECs	11,898	25,998
Small ILECs	650	650
Municipalities	1,900	6,757
RBOCs	400	400
Total	14,848	33,805

Source: Press Releases, Company Websites, Primary Research